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HANDBOOK

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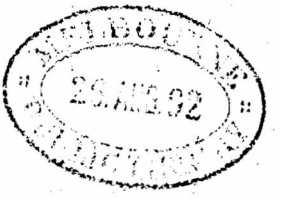
FOR THE

8-IN. R.M.L. HOWITZER OF 46 CWT.

MARK I.

On Bed and Siege Platform or on Siege Travelling Carriage.

LAND SERVICE.



1890.

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Note.—This Handbook is corrected up to July, 1890. Any alterations which may be suggested should be forwarded to Assistant to D. of A., Woolwich.

8-inch R.M.L. Howitzer of 46 Cwt.

MARK I.

HOWITZER.

(*List of Changes*, §2507.)

Plate I.

Material	exterior	Wrought iron
	tube	Tough steel
Length	nominal	61·125 inches
	total	64 inches
Weight, nominal		46 cwt.
Preponderance		2 cwt.
Bore	calibre	8 inches
	length	48 inches
	capacity, including unrifled portion	2414 cubic inches
Chamber	diameter, smallest	6·76 inches
	length	12·5 inches
	capacity	629·0 cubic inches
Rifling	system	Woolwich
	twist	Uniform 1 in 16 calibres
	length	35·5 inches
	grooves: number	4
	grooves: depth	0·18 inches
	grooves: width	1·5 inches
Means of rotation		Copper gas-check with four projections.

The howitzer is vented at an angle of 6° 3′ from the vertical, and the vent strikes the bore 1·75 inches from the bottom of the chamber. Planes for cross-levelling are cut upon the cascable button and the front portion of the breech-coil, and a plane for quadrant elevation immediately in front of the vent.

The howitzer should be examined after every 100 rounds.

Sights.

The piece is sighted on the right side on the plan proposed by Major French, R.A.

The tangent sight drops into a socket, and is set vertically. The bar of steel is graduated to 15°, adjustment being effected by a removable clamp. The bar has a bronze head with clamping screw, and a steel horizontal cross bar, which slides within the head to the extent of 1° to the right, and 3° to the left, to compensate for wind and deflection of projectile. The bar is provided with a sliding reversible leaf, having a notch for direct laying; this leaf is provided with a pointed sight for rough laying, and cross wires for fine laying when used reversed. The bar is graduated from 0° to 8° right for the right side.

The fore sight consists of a steel stem with horizontal cross bars forged solid, fitted into a gun-metal socket with bayonet joint. The bar is fitted with a sliding reversible leaf, having a point for direct laying and an open notch and eye-hole for rough and fine sighting when used reversed. The cross bar is graduated from 0° to 8° to correspond with the tangent sight bar.

These sights can be used for either direct or reverse laying.

For direct laying, the notch of the tangent sight is used in conjunction with the point on the fore sight, and for fine laying, the sliding leaves are exchanged, and the eye-hole and cross wires used in conjunction. For direct laying, the method of proceeding is the same as when using service sights of the ordinary pattern: the only special feature being that both sliding leaves must be clamped at corresponding divisions of the respective cross bars, so as to obtain a line truly parallel to the axis of the gun; any deflection which may be required is given on the part of the bar especially graduated for the purpose.

For reverse laying, the notch of the fore sight is used in conjunction with the point on the tangent sight, or the eye-hole of the fore sight with the cross wires of the tangent sight.

The mode of proceeding is as follows:—

The line of fire is obtained by any of the recognized methods, after which the howitzer is laid by clinometer or quadrant for the first round.

Before firing, an "aiming point" is selected to the rear of the platform, in prolongation of the line joining the sights, the leaves of which are for the purpose shifted on the cross bars, and clamped in any required position, without restriction as to keeping to corresponding divisions; the tangent scale being at the same time set to any convenient elevation (which need not necessarily be the elevation at which the piece is laid).

If near to the platform, the aiming point must be supplemented by a plumb-line suspended at a fixed point between it and the howitzer to mark the line of fire; but if at a considerable distance in rear, the use of a plumb-line can be dispensed with, especially when battens on the platform or other means are used to ensure the gun being in the same position after each round.

After the first round any necessary correction for elevation or deflection is made, and the aiming point, as above described, is used to lay on, the clinometer being no longer necessary.

Before firing, the sights are securely clamped. After each round any required alteration in the amount of elevation or deflection is given on the tangent sight, and the howitzer being run up, is laid on the aiming point without altering the position of the sights, except when the plumb-line is used, in which case, to avoid cross-lifting, it may be found necessary to shift both sliding leaves an equal number of divisions to right or left on the cross bars.

For night firing, or when there is much fog, a luminous aiming point is required. This may conveniently be obtained by the use of a bull's-eye lantern, with wires crossed in front, fixed to a post; the light being softened by placing paper or other suitable material over the glass. In this case a plumb-line will usually be required, and the aiming point will be the point where the plumb-line covers the intersection of the wires on the lantern.

Battens or chalk-lines on the platform will generally be found useful.

Instead of being sighted as above, some of these howitzers are provided with three sights, viz., a muzzle sight, foresight, and tangent sight. The tangent sight is graduated in degrees up to 15°, and is fitted with a leaf sliding 4° to the left and 1° to the right. The foresight is fixed on the end of the breech coil and is used for elevations not exceeding 3°. The muzzle sight is used for elevations over 3°. This system is, however, obsolete.

MOUNTINGS.

Bed, howitzer, R.M.L. 8-inch 46 cwt., with directing bar, compressor, and elevating gear.

(*List of Changes*, 4002.)

Plate II.

The bed consists of two double plate wrought-iron brackets, connected by two transoms and a bottom plate. Each bracket is fitted with three metal rollers on steel axles, and a metal bushed square hole for the transporting axletree.

Elevating Gear.

The elevating gear is fitted on the right bracket, and consists of a worm spindle with worm wheel and pinion, conveying motion from a hand wheel to an arc pivotted to the howitzer. The worm wheel is fitted with an adjustable friction cone which, by allowing a slight slip to the arc, reduces the shock on the gear when firing.

The gear is enclosed on the outside of the bracket by a metal cover.

Compressor Gear.

The compressor gear consists of a bow or cramp fitted with a screw and lever at each end for adjustment and compression, by which three hanging plates on each side, projecting through openings in the bottom plate, are forced against the sides of a directing bar and compressor bars. The inner hanging plates have each a clip on the inward side, which catch against guide plates on the directing bar and prevent the bed rising during recoil. Two plates are fixed on the bottom plate of the bed, to prevent the compressor plates shifting. The compressor lever works on an arc on the left bracket on which is a projection to hold the lever down when compression is on. The adjusting lever works on an arc on the right bracket, to which it can be keyed to the required adjustment.

The directing bar is built up of channel and plate iron. It is fitted with a hinged metal flap in front, which fits over a pivot on the ground platform, and it has an eye at the rear end, by which it can be hooked up to an ordinary siege limber. A buffer stop of iron plates and india-rubber pads, is fixed at each end. The front of the bar is slightly tapered, to allow the bed a slight recoil, before the compressor comes fully into action.

To Adjust and Work the Compressor.

Before practice run the bed back about 3 feet from the front stops, and adjust the compressor by means of the adjusting lever,

until one man exerting his whole power on the compressor lever, can just force it past the projection on the arc; then secure the adjusting lever by the key, release the compressor lever, and run the howitzer up for firing.

Should the recoil be too violent, the adjusting lever must be moved one or more holes towards the front of the bed, and again secured by the key.

If the lever can be forced too far to the front to give the required adjustment, remove the nut and collar of the screw, take off the lever, and place it on the next position of the hexagon of the screw towards the rear, and secure it with the nut and collar. Should the recoil be less than required, a similar alteration must be made in the position of the lever, but in a reverse direction.

To Run Up.

Release the compressor lever by lifting it past the projection to the stop on the arc.

As the compressor is not self-acting, great care must be taken that the compressor lever is always pressed down past the projection before each round, as soon as the howitzer is run up.

For no other purpose than adjustment should the adjusting lever be moved; it is tightened when moved to the front, slackened by moving it towards the rear.

Elevation	45°
Height to axis of trunnions	2 ft. 6 ins.

	Weight.	Tonnage.
Bed	24·75 cwt.	1·187 tons
Directing bar ..	8·25 „	0·216 „

Platform, siege, R.M.L. howitzer, wood, 8″, 6·6″, and 6·3″ beds.

The platform is constructed to be readily taken to pieces for transporting, and to allow a traverse of 5° on either side of the centre line. It is of oak, and consists of two side baulks, dovetailed and bolted to a front and rear transom, with two centre baulks housed between them. The whole is strengthened by a strap of iron secured across the middle on the underside. Part of the platform is plated with iron to protect it from wear by the bed rollers; the transoms and side baulks are hooped to prevent splitting, and a cast-iron rack is let into the rear transom to facilitate traversing by handspikes.

A wrought-iron pivot for the directing bar is fitted in the front transom, and secured on the underside by bolts and keys.

Weight, 21 cwts.

Note.—The bed and platform were originally in the siege train, but they are now used for arming permanent fortifications. The angle of traverse will be increased by joining two platforms together, with a centre piece between. See para. 5541, List of Changes.

Carriage, siege, R.M.L. 8-inch 46 cwt. howitzer, central pivot.

Iron; without limber, with hydraulic buffer.

(*List of Changes*, 3006.)

Plate III.

This carriage, which is constructed to allow 30° elevation, was originally intended to admit of the howitzer being fired from the trail with the wheels off. For this purpose the trail brackets project to the front, and are fitted with a bottom plate extending from the rear transom to the breast of the trail. This plan has been superseded by the bed already described.

The carriage consists of two "double plate" brackets connected by two wrought-iron transoms and a distance bolt, and strengthened by knee plates riveted to the top of the rear transom.

The axletree bed is constructed on the box girder principle, by angle iron riveted on each side of the axletree; it is housed into the trail, flush with the underside of the brackets.

Elevating Gear.

The elevating gear consists of a cross shaft conveying motion from a hand wheel on the left side to two bevel wheels on the right side, which by means of a worm spindle, actuate a worm wheel keyed on to a spindle pinion which gears into the elevating arc.

The arc is pivotted to the howitzer, and is kept in gear by two friction rollers. The worm wheel is fitted with a friction cone, which can be adjusted by means of two nuts, to allow sufficient slip to prevent damage when firing.

The wheels are 1st class, B, No. 6, 12 inch pipes, 5 feet diameter, 6 inch tire. The naves are of metal and the pipes of phosphor bronze.

The carriage is mounted on a double-decked platform, which is fitted with a central pivot, for the attachment of the hydraulic buffer.

The piston rod of the buffer is secured to the trail by a long bar, the front end of which is supported by a bracket, and the buffer cylinder is fitted with a trunnion ring, which is secured in bearings on the pivot plug.

For travelling the buffer is raised and supported along the underside of the carriage by chains.

Hydraulic Buffer.

The buffer is of special pattern for use with siege carriages. The cylinder is of steel, and the front and rear caps are of wrought iron.

A ring with trunnions is fitted on the centre of the cylinder, and connected to the front cap by the bars. The front cap has a stuffing box for a leather ring and cotton packing. The piston rod is fitted with a link by which it is shackled to the long bar on the trail. There are four holes, ·35 inch diameter in each piston for the passage of the fluid.

The buffer is 5 feet 1½ inches long internally, and the piston is 2 inches thick, thus the buffer allows of an extreme recoil of

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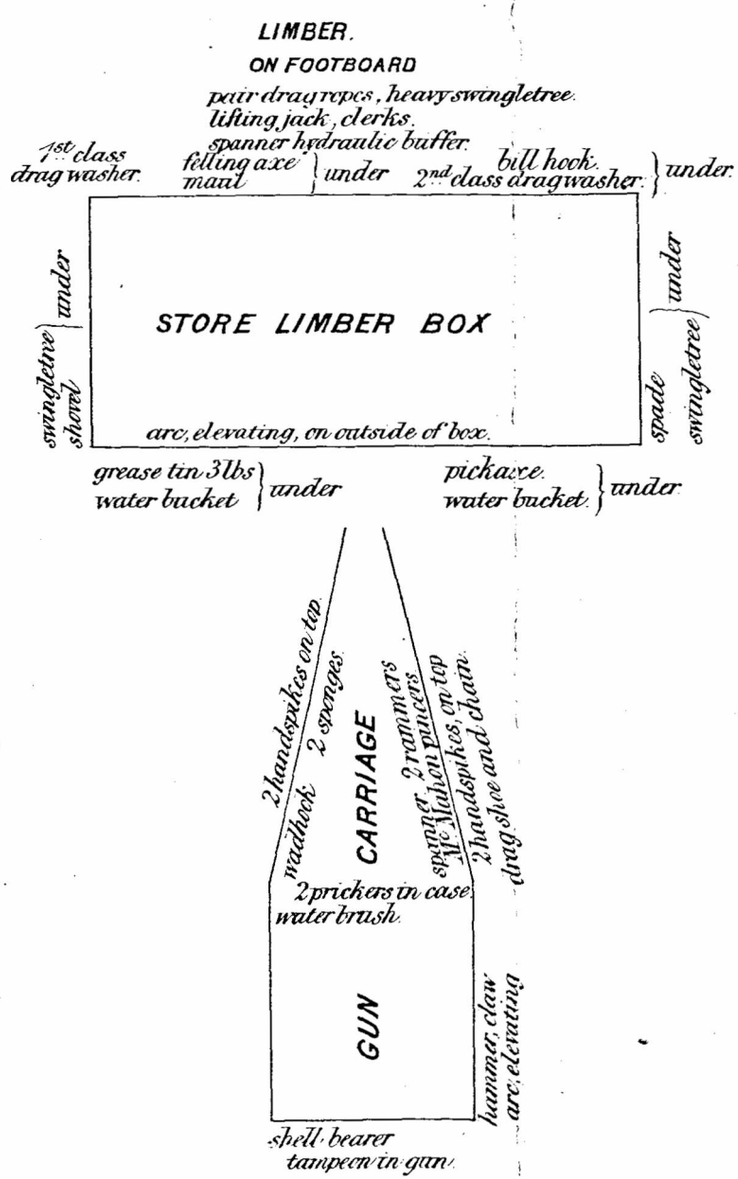
CARRIAGE AND LIMBER FOR 8IN HOWITZER 46CWT.



LIST OF STORES CARRIED IN THE STORE LIMBER BOX.

Bit, vent, 17 inch,	1.	Marline	lbs 3.
Can, oil lubricating,	1.	Match slow	lbs 1.
Chalk, white,	ozs. 4.	Pin, linch, 1st class,	1.
Clinometer, in case,	1.	Pin, linch 2nd class,	1.
Clippers, portfire,	1	Pocket, faze,	1.
Cloths, sponge,	6	Pocket, tube,	1.
Couples, trace,	2.	Portfire, common,	4.
Cylinder with 6 bits,	1.	Reel, chalk line,	1.
Drift, wood,	1	Scissors, laboratory,	1.
Driver, screw,	1.	Sights, tangent,	2.
Extractor, faze,	1	Sights, trannion,	2.
Hemp, undressed,	lbs 2.	Spikes, common,	2.
Hook, borer,	1.	Spike, spring,	1.
Instructions, printed,	1.	Stick, portfire,	1.
Key, plug, G.S.	1.	Tubes, friction,	25.
Knife, clasp,	1.	Twine, whipping	lbs 1
Lanyards, friction tube,	3.	Vent, servers with lanyards,	2
Line, chalk,	1	Washer, 1st class,	1.
Line, hambro,	1	Washer, 2nd class,	1.

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4 feet 11½ inches; practically 4 feet 9 inches should never be exceeded.

Dimensions of Carriage.

Height to centre of gun			4 feet 8·5 inches
Length	carriage		11 „ 8 „
	axletree		6 „ 3·5 „
Track of wheels			5 „ 2 „
Angle of trail			17°
Weight	carriage		47·25 cwt.
	hydraulic buffer		4·25 cwt.
			51·5 „

Limber, siege, R.M.L. howitzer, L.S., armaments 8-inch 46 cwt.

This limber is the pattern approved for iron siege carriages.

The futchells, splinter bar, axletree bed, and axletree are of wrought-iron, the two latter forming together a beam of box girder section.

The limber hook is steeled and fitted with a steel key to secure the trail of the carriage or directing bar of the bed.

The wheels are 2nd class, B, No. 25, 5 feet in diameter, 3 inches tire, with metal naves and phosphor bronze pipes.

The washer is a "loop washer" having a shorter loop than the field washer, for the attachment of outriggers.

The limber is fitted with two pairs of shafts, one pair framed, the other "*near*" and "*off*" and two outriggers with stays, for four horse draught.

The limber box has a sloping top, and is fitted to carry the stores detailed on page 7.

		cwts.	qrs.	lbs.
Weight	limber	6	3	22
	wheels	4	2	4
	limber box	0	2	2
		12	0	0

Platform, siege, double-decked, C pivot, Mark I, wood ground.

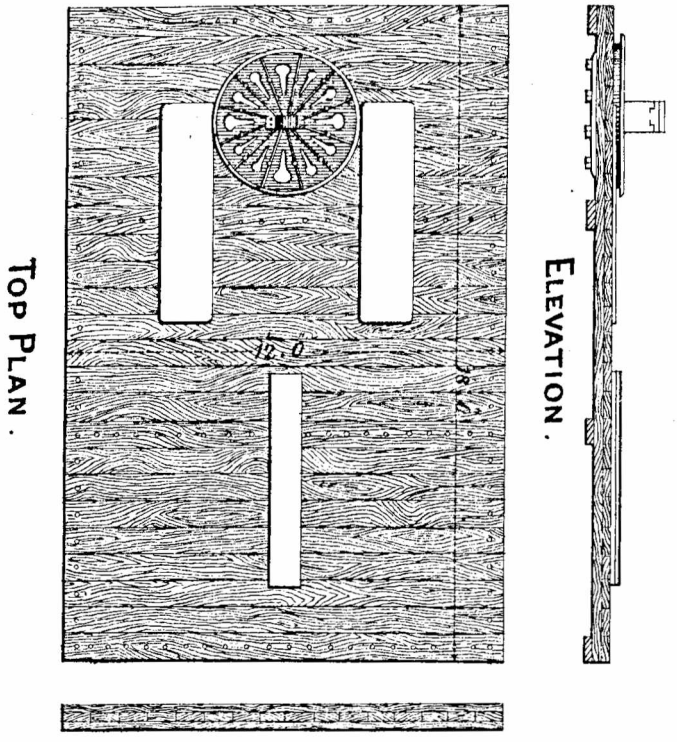
Plate III.

All siege carriages fitted with hydraulic buffers, whether mounted in permanent works or in hastily constructed positions, will be attached to a central pivot, fixed on a double-decked platform.

The platform consists of two layers of 3-inch fir planks, those of the bottom layer parallel to the line of fire, those of the upper layer at right angles to it. Under the bottom layers are placed four transverse planks, one at the front, another at the rear, and the other two dividing the distance between them. The layers are connected by screws, through both ends of all the planks and along the four transverse planks.

PLATFORM SIEGE DOUBLE-DECKED "C" PIVOT (MARK I.)

With plug, pivot, N°17.



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The platforms should be laid at a slope of 1 in 24 (2° 23′) to the front, with a clear space of 1 foot between the front of the platform, and the foot of the interior slope.

The pivot plate is a circular steel casting with a socket in the centre to suit the pivot plug by which the buffer is secured. It is fixed in position by 12 bolts, which pass through the planks, and a steel plate on the underside of the platform.

The pivot plug is a steel forging, in which bearings are formed for the trunnions of the hydraulic buffer.

	cwt.	qrs.	lbs.
Platform, with pivot plate	43	3	0
Pivot plug	2	3	0
	46	2	0

Plates, wheel, platform, siege, ground, steel, 2 per set.

The wheel plates are of steel 18 inches by ½ inch by 6 feet, one of these plates is to be placed under each wheel of the carriage, to protect the upper layer of the platform.

Weight of each plate, 1 cwt. 2 qrs. 10 lbs.

Planks, trail, siege, Mark II, steel shod, ground platform.

The trail plank is of oak, 12 inches by 3 inches by 6 feet, shod on both sides for the whole of its length with channel steel, and fitted with four rope handles. It is to be placed under the trail to preserve the platform from injury.

Weight, 2 cwt. 1 qr. 7 lbs.

General Instructions for Care and Preservation.

Care should be taken that all nuts and screws are properly tightened up; if removed, they should be slightly oiled before being replaced, and to prevent damage by the threads crossing, a few turns should be given by hand before using the spanner. On no account should a hammer be employed for removing the nuts or screws.

All bright parts should be kept clean, and when not in use, slightly oiled; all working parts must be kept free from clotted oil and dirt, and properly lubricated. Loose working parts when not in use, should be greased and placed in store.

The wheels and axletrees should be occasionally examined, cleaned, and greased.

The compressor plates and bars of the bed are on no account to be greased, but the rust should be removed by scraping (if any is allowed to accumulate) to obtain regularity in working.

On the carriage, before action, it must be ascertained that the buffer cylinder contains the requisite quantity of fluid, that there is no leakage at the gland, and that the buffer is properly secured to the carriage and the pivot plug.

To fill the cylinder:—Run the carriage up, remove the filling hole plug, and run the fluid in by means of the gallon measure.

The fluid is withdrawn through the front valve, air being let into the cylinder at the same time through the filling hole.

If leakage occurs at the gland and tightening up the latter does not remedy it, the packing must be renewed.

To renew the packing:—Remove the shackle from the piston rod, unscrew the gland, and with the tang of a file extract the cotton packing; then by withdrawing the rod the remaining portion of the packing, *i.e.*, the metal ring and leather collar will come out with it. Place the new leather on the rod so as not to damage its thin edge, follow it with the metal ring, and press them both home to the bottom of the stuffing box; insert the cotton packing and tighten up the whole with the gland.

The cotton rings should be $\frac{1}{4}$" less in length than the circumference of the piston rod, and the ends must be bound with cotton yarn. When required for use, the ends must be well greased with tallow, and placed in the stuffing box so as to break joint.

Care must be taken to prevent the lodgment of water on any part of the mountings, and the points of the limber shafts must be kept off the ground.

Defects or damage must be made good without delay, and if any of the paint work becomes rubbed off, it should be patched over as soon as possible.

The registered number of these mountings must be quoted in all correspondence referring to them, to ensure identification.

Projectiles.

(*List of Changes*, §§4014, 5395.)

Plates IV, V, VI, VII.

		Weights (filled and fuzed with gas-check).
Shell — common	Marks I* and II, iron studded ..	180 lb.
	Marks I and II, iron studless ..	
	Mark III, cast steel, studless ..	
shrapnel, Mark I, cast steel, studless ..	..	
star, Marks III and IV	..	22 lb.
Shot, case, Mark III	..	74 lb.
Gas-check — with plug, Mark I.	..	4 lb. 8 oz.
automatic, Mark I.	..	7 lb. 8 oz.

Descriptions.

Common Shell.

The Marks I* and II studded, are of cast iron, and exactly similar to that for the 8-inch R.M.L. gun with the exception of the studs, which are all of one size. There are two rings of four studs each. The Mark II differs from Mark I* in having the hole for the plug passing completely through the base. The latter pattern was not originally intended for a gas-check, and the hole has been bored out since. No more studded shells will be made.

The studless shell are interchangeable for the 70 cwt. howitzer and also for the gun, but require different gas-checks for each nature of ordnance.

The Marks I and II studless shell are made of cast iron, cast with bands and turned to the proper dimensions. The base for a length of ·9 inches is reduced to 5·06 inches diameter, and cast with a circular groove for attaching a gas-check; 37 serrations are cast on the base, by which means the gas-check imparts rotation to the shell. The head of the shell is struck with a radius of 1·5 diameters, the point being truncated, bored out, and screwed 14 threads per inch, to receive a gunmetal bush which is bored out and tapped to the G.S. fuze-hole gauge, and recessed ·2 inches below the nose of the shell. In the Mark II the bush is flanged. This is the only difference betwen the two marks. There are two holes drilled in the head to receive the claws of the extractor.

The body of the Mark III shell is of cast steel, annealed after casting. It is similar to Mark II iron shell, but the head is struck with a radius of 2 diameters.

A hole is bored in the base of Marks II and III, screwed 9 threads to the inch, left handed, and countersunk, to receive a gun-metal plug screwed to suit the hole, and having a recess to receive the key.

The interiors of the shell are lacquered with a composition composed of resin, Spanish brown, plaster of Paris, and turpentine.

The bursting charges of the common shell are:—

	P.		F.G.		Total.		
	lb.	oz.	lb.	oz.	lb.	oz.	
Marks I* and II, studded	16	2	3	0	19	2	in serge bag.
Marks I and II, studless..	16	0	2	8	18	8	in dowlas bag.
Mark III, studless ..	22	3	3	12	25	15	,,

Incendiary Stars for Common Shell.

These stars are intended for filling common shells which are to be used for incendiary purposes. Each star consists of a hollow paper cylinder about 2 inches in length, ·7 inch in external diameter, and ·5 inch in internal diameter, soaked in paraffin wax, and filled with the following composition, viz., india-rubbber solution, 2 oz.; mealed powder, 5 oz.; ground saltpetre, 1 oz.; paraffin wax, ¼ oz.; naphthaline, ¼ oz.; coal tar, 1 oz.; each end of the star is primed with quick-match. The stars are tied up in paper bundles of eight each and packed in quarter metal-lined cases or loose in metal-lined boxes.

Shrapnel Shell.

This shell is interchangeable for the 46 cwt. and 70 cwt. howitzer. The body of the shell is made of cast steel, annealed after casting. It is cast with bands turned to final dimensions. The base for a length of ·9 inch is reduced in diameter, with a circular groove for attaching the gas-check; 37 serrations are cast on the base, by means of which the gas-check imparts rotation to the shell. A hole is bored in the base and screwed 14 threads to the inch, left-hand,

and countersunk, into which is fitted a gun-metal plug, screwed to suit the hole, and having a recess for the key.

The head is made of charcoal iron, or Bessemer metal, and is struck with a radius of 2 diameters, the top being truncated to receive a gun-metal socket, which is screwed to G.S. fuze-hole gauge, and attached to the head with solder. The head is fitted with a wooden block, and attached to the body of the shell by 12 rivets; 6 pins are also inserted to prevent the head twisting; the holes for these twisting pins are slotted through to the bottom of the head. The rivets and twisting pins are covered with solder brought up to correct outline.

Two holes are drilled in the head, into which tin cups are fitted to receive the claws of the extractor.

The shell has a disc of steel, with a hole screwed in the centre to receive a gun-metal tube, placed over the powder chamber, and resting on the shoulder formed to receive it, the disc is imbedded on its seat with red lead.

The powder chamber is much larger than in the ordinary type of Shrapnel; it is lacquered, and contains a bursting charge of 2 lbs., which is inserted through the base.

A gun-metal or brass tube screwed at the lower end fits into the steel disc, whilst the upper end is fitted with a short tube screwed to receive a primer; the upper part of this tube is connected with the fuze socket by means of a conical tin tube.

The inside of the shell is lined with brown paper, and contains 540 mixed metal balls (14 to the lb.), the interstices being filled in with melted resin.

Star Shell.

Mark IV shell, which is intended for use also in the 70-cwt. howitzer, is made of two hemispheres of Bessemer metal 0·259 inches thick, tinned all over, and fitted together with a lap joint, the inside of each hemisphere being strengthened by a wrought-iron ring.

The upper hemisphere is fitted with a gun-metal socket for a wood time fuze, and the lower hemisphere is fitted inside with a wooden disc and ring primed with quickmatch. The two hemispheres are secured together by six screws and six twisting pins. In order to keep the fuze hole in an axial position when loading, a ring of yellow pine is glued and soldered on to the lower hemisphere.

The shell contains 31 stars, filled with improved magnesium light composition. Each star has a small hole in each end primed with quick-match and sulphur to ensure their simultaneous ignition, and each is bound over the ends and several times round the body with soft copper wire to prevent its breaking up in the shell.

Mark III shell, contained only 21 stars, filled with magnesium signal light composition, and the wooden ring on the outside was less securely fastened.

This shell will be fired with a 2½-lb. charge, and 15 seconds wood time fuze, with special gun-cotton priming. As a rule it should burst about 100 feet above the plane, so as to ensure sufficient dispersion of the stars before reaching the ground.

15 degrees elevation, and fuze bored at 10, gives about 900 yards range.

35 degrees elevation, and fuze full length, gives about 1700 yards range.

Case Shot.

This shot, which is also for use in the 8-inch R.M.L. gun and 70-cwt. howitzer, is made of tinned iron in one piece, riveted longitudinally, and fringed at both ends. The bottom fringe is bent down and riveted to the sheet-iron bottom, and when the case is filled the upper end is bent over and soldered to the tinned-iron top. An iron handle is attached to the top by iron staples, which are bent round to form a loop, and riveted to the inside of the head. In the interior of the cylinder is a wrought-iron disc lying loosely on the bottom, and on this stand three wrought-iron segments forming a lining to the case. The contents are 75 sand shot of 8 oz., weighing 36 lb. 7½ oz., and 9 lb. 8 oz. of clay and sand.

Gas-checks.

Both gas-checks are of copper, and have the rim made with four projections, which are planed to the same twist as the studs on the shell. The gas-checks have eight fire holes, ·2 inches diameter, which pass through the side of the rim. These are for the purpose of allowing the passage of sufficient flame to ignite the time fuze. The gas-check is attached to the shell by means of a metal plug fitted with an hexagonal head requiring a special "spanner gas-check plug."

The studless common and the Shrapnel shell take an automatic gas-check, which is formed somewhat like a soup plate to fit, on shock of discharge in the gun, on the base of the shell, which is prepared with serrations, &c., to receive it.

Instructions for Preparation of Shells.

Fixing Gas-checks.

Fitted with Plug.

Unscrew and remove the plug with the "spanner gas-check plug." Place the gas-check on the base of the projectile with the concave, or unpainted side, next the base; insert the plug, and screw it well home with the spanner until it binds against the gas-check, taking care that the projections on the gas-check are in the line of the studs of the shell.

Automatic.

These gas-checks are loaded for service separate from the shell, and become fixed to them when the gun is fired. For drill purposes place the gas-check on the base, and strike it with a pointed hammer or chisel so as to make an indent at two or three points in that part which surrounds the neck of the projecting base of the shell.

Filling Shell.

Common Shell.

Weigh out the bursting charge in proportions of about 4 lb. P and 10 oz. F.G.

The studded shell is filled from the head, the studless from the base. With the former remove the fuze-hole plug with the "key fuze universal" or the "key plug G.S."; with the latter remove the base plug with the "wrench base plug," the shell having been tilted on its point in a hollowed piece of wood and being retained in this position by means of the "holder shell."

In the case of the studless shell drop in three "bags primer filled 7 drams."

Place the filling rod in the "bag-burster" and insert it into the shell, taking care not to force the end of the rod through the bag; carefully push the bag in until the neck only is in the fuze or plug hole, as the case may be, a portion being kept outside, as the whole bag must not be allowed to slip into the shell during the operation of filling; then withdraw the rod.

Next drop in one portion of P. powder pebble by pebble, then insert the funnel and pour in one portion of F.G., tapping the exterior of the shell at the same time with a wooden mallet.

Repeat the operation till the shell is completely filled.

Now tie up the neck of the bag with the twine which is attached, and which may be shifted to its proper position if necessary; cut off the end of the choke, and push it in well down and to the side of the hole.

In the case of the studded shell now drop in one or more "bags primer filled 7 drams."

See that the fuze or plug hole is quite clean; lubricate the plug, and screw it home.

Incendiary Stars.

A common shell will contain about 255 incendiary stars with a bursting charge of about 5 lb. 6 oz. The shell should be tilted to one side, and the stars put in gradually and occasionally set or shaken down so as to bed themselves evenly together, powder being introduced from time to time to fill up spaces between the stars. A small wooden stick will be found of assistance in getting the stars well in. When no more stars can be inserted, and the shell is tightly filled, the fuze or plug will be inserted as may be required. Before using the shell, which will be fuzed as usual with a percussion fuze, it should be ascertained that there is powder close to the fuze-hole.

Shrapnel Shell.

These are filled through the base. First remove the plug from the fuze-hole and drop in the "primer Shrapnel shell Mark III," and by means of the "driver, screw, Shrapnel, large," screw it tightly into the tube and replace the plug. Then turn the shell on its point and remove the base plug. Carefully weigh out the bursting-charge (Pistol, F.G., R.F.G., or R.F.G.^{2}) and pour it into the shell through the leather funnel, tapping the shell with a wooden mallet till the whole of the charge has been inserted. Then replace the base plug.

Star Shell.

These shells do not require to be filled—they are ready for the insertion of the fuze when the plug is removed.

Unscrew and remove the metal plug.

Insert the wood time fuze very firmly in the usual manner after it has been bored to the required length.

The fuze must not be uncapped until the shell is placed in the muzzle of the gun. These fuzes are "uncapped" by taking hold of the small end (coloured white) of the band, which is left exposed, and unwinding from left to right smartly, so as to thoroughly detach the band from the head of the fuze, and to leave the priming fully exposed. The extra priming of dry guncotton should not be disturbed.

The cartridge and shell should be rammed home simultaneously, making use of the sponge head for this purpose. It is necessary that the sponge should be dry. (The recess in the rammer is liable to grip the head of the wood fuze.)

Examination of Filled Shell.

Common.

With the studded shell remove the fuze-hole plug, also the "bags primer" with the "Hook G.S. wads."

With the studless shell unscrew the base plug by means of the "wrench base plug."

Draw out the neck of the bag with the Hook G.S. wads, untie the twine, and examine the powder. If the powder is in a serviceable condition, tie up the bag and proceed as directed above for filling shell. If it is caked from damp, upend the shell and empty it.

If means are available, a wooden horse placed over the open mouth of an empty powder-barrel should be used, and a piece of metal tubing, or a piece of sheet copper rolled up into a tube as large in diameter as can be inserted through the neck of the bag, will greatly facilitate the extraction of the powder.

Take out the bag, and if it is in a serviceable condition, replace it in the shell, the "bags primer," if serviceable, being also replaced. If the powder is so caked that it will not run out of the shell, or if any powder remains adhering to the interior of the shell, fill the shell with boiling water and allow it to stand for about five minutes, then pour out the water and fill up again with boiling water. After standing for 15 minutes more, the shell may be emptied, using the copper scraper for shells to facilitate the removal of the wetted powder. The scraper must not be applied until after 15 minutes have elapsed after the second quantity of boiling water has been poured in. If necessary the addition of boiling water will be repeated until the whole of the bursting charge has been extracted. When the shell is perfectly dry, refill with serviceable powder.

Shrapnel

Remove the fuze-hole plug, unscrew the primer with the "driver screw shrapnel, large, Mark III," and lift out the primer with the "pincers shrapnel primer." If the primer is serviceable replace it

and the plug; turn the shell-nose downwards and remove the base plug. Turn the shell base downwards, and if the powder flows out freely and is serviceable, replace powder and plug; if the powder is caked from the effects of damp, &c., the base plug will be replaced, and steps taken for the exchange of the shell.

Fuzes.

Plates VIII to XII.

Direct Action, No. 3, Marks I*, II, and III.
,, delay No. 10 for high angle fire.
Time Sensitive, long, No. 23.
,, middle, No. 24.
Time, 15 seconds M.L. special priming, No. 42, for use with star shell.

Fuze, Percussion, Direct-Action, No. 3.

The Mark II fuze is made of gun-metal, turned all over, and screwed below the head to fit G.S. fuze-hole. The interior is bored out at the lower end for the powder charge, and closed with a screw base plug. A recess in the upper part of the fuze is charged with detonating composition, and the holes communicating with the magazine are filled with powder priming. The fuze is fitted with a steel needle, passing through and secured in a copper suspending disc ·032 inch thick. The lower part of the fuze is filled with pistol powder. A gun-metal cup having a T-shaped slot cut out in each side to fit over the projecting pins in the head of the fuze, is secured over the top.

On striking any object, the suspending disc is driven in, and the needle is forced against the detonating composition, thereby exploding the fuze.

Mark I* is the obsolete Mark I altered and is practically identical with Mark II.

The Mark III differs from the above in being screw-threaded throughout so as to screw in flush with the point of the shell. It is also closed by a plug which is screwed with a left-handed thread in place of the cap.

Fuze, Percussion, Direct-Action, with Delay No. 10, Mark I.

This fuze is generally similar to the Fuze, Percussion, Direct-Action, Mark III, but has a delay arrangement in addition. It consists of a body, screw plug for needle disc, disc with needle, screw collar, safety plug, delay action plug, and a base closing plug.

It requires no preparation beyond the removal of the safety plug (which is threaded with a left-handed screw) by means of the "Key-fuze universal" after entering the shell into the muzzle.

On impact the copper disc with needle is driven in on to the detonator: the flash is then led to the delay arrangement by means of threads of quickmatch through an air space. The pressed pellet of mealed powder, the burning of which gives the delay, is thus ignited and burns about one second, then ignites the fuze magazine of loose powder which fires the shell burster.

Fuze, Time, Sensitive, Long, No. 23.

The fuze is made of gun-metal, turned all over, and screwed to suit G.S. fuze hole. The interior is bored out at the lower end for the powder charge, and screwed at the bottom to receive a base plug. The upper part of fuze is fitted in the interior with a lighting pellet, two retaining pellets, two spiral springs (to keep the retaining pellets hard against the lighting pellet) and a needle; an axial magazine is screwed in the centre of stem, and the upper part of fuze fitted with a composition ring (numbered from 1 to 60, reading to quarter units round the outside, and having three escape holes through the inner side) a dome, and cap. The lower part of body of fuze is filled with powder, covered with a disc of shalloon, and the bottom closed with a screw plug of gun-metal having a hole through the centre, and dished out at the bottom, the hole is closed with a brass disc spun in. The fuze has two safety pins, one passing through each retaining pellet, and each having a loop of tarred line attached.

At the moment of loading the safety pins are withdrawn, and when shell is fired the rotation causes the retaining pellets to fly out, releasing the lighting pellet which strikes the needle, the flash igniting the axial magazine communicating with composition ring which burns to the time set, and then ignites the powder in diagonal hole leading to magazine and fires the fuze.

Fuze, Time, Sensitive, Middle, No. 24.

This fuze differs in dimensions only from No. 23 described above, and burns half the time. The composition ring is numbered from 1 to 30, and reads to quarter units.

Fuze, Time 15 Seconds, M.L., Special Priming, No. 42, Mark I.

The fuze is made of beech-wood turned to a cone of 1 in 9·375 inches. The interior is bored out to within ·25 inch of the bottom, and fitted with a brown paper cylinder containing fuze composition and pressed mealed powder, and the top closed with a screw plug of gun-metal, having a copper pin projecting to hold the bights of the quickmatch priming. Three escape holes are bored through the side of head through which the quickmatch priming is passed, wound round the head and covered with strands of gun-cotton priming, and the head covered with a cap of white fine paper. Six rows of side holes are bored at right angles to the axis of fuze, and six channels are bored in line with side holes and parallel to the axis; the channels are filled with pistol powder connected at the base by quickmatch; the side holes are filled with pistol powder pressed, and covered with white fine paper.

An index paper graduated to 30, and showing by yellow dots the position of side holes, is pasted round the body of fuze and the surface varnished.

A copper band covered with tape is secured round the head of fuze. The head is painted red, and the end of band white.

Preparing and Fixing Fuzes.

Direct Action and Direct Action Delay.

The fuze is screwed into the shell by the "key, fuze, universal," or the "key, fuze, G.S."

Remove the cap or plug only immediately after entering the shell into the muzzle.

Long and Middle Sensitive Time.

These fuzes are screwed into the shell before being set by the "key fuze universal," using the semicircular arm with the small projection on it which fits into a hole in the body of the fuze. To set, loosen the nut with the "key, fuze, universal," and turn round the composition ring, with which the dome will also move, until the required graduation on the ring is opposite to the arrow head on the body, and clamp the nut. At the moment of loading withdraw both the safety-pins, which will be found protruding from the composition ring.

Fuzes, Time, Wood, M.L., 15 secs., with special priming, No. 42.

These fuzes are fixed in the fuze-hole by screwing the fuze round by hand until it is held firmly. These fuzes are "uncapped" by taking hold of the small end (coloured white) of the band, which is left exposed, and unwinding from right to left smartly, so as to thoroughly detach the band from the head of the fuze, and to leave the priming fully exposed. The extra priming of dry guncotton should not be disturbed. The uncapping must not be done until the shell is placed in the muzzle of the gun.

Charges.

Range tables at pages 21 to 27 are calculated for the following charges of R.L.G.[2] lb. 10, 9, 8, 7, 6, 5, 4, 3, 2.

Filling Cartridges.

The empty cartridges are of three sizes, and when filled should be of the dimensions shown below, according to the weight of the charge inserted:—

		Length.	Diameter.	Braids.
In cartridge 7 to 10 lb.	10 lb. ..	8·75″ to 9·25″	6·8″	3
	9 „ ..	7·6″	6·8″	3
	8 „ ..	6·7″	6·8″	2
	7 „ ..	6·0″	6·8″	2
In cartridge 6 to 4 lb.	6 „ ..	6·5″	6·3″	1
	5 „ ..	5·75″ to 6·25″	6·3″	1
	4 „ ..	5·0″	6·3″	1
In cartridge 3 and 2 lb.	3 „ ..	4·0″	6·0″	1
	2 „ ..	3·3″	5·6″	—
	2½ „*			

Care will be taken to see that the empty cartridges are thoroughly

* For use with star shell only.

dried before being filled, and the proper charge will be carefully weighed out, and inserted in the cartridge by means of the "funnel, copper, cartridge."

The cartridges are choked as follows:—The mouth is drawn together into several plaits with a nickel silver needle threaded with two strands of silk twist;* after drawing together the mouth of the cartridge, three turns will be taken round the plaits, and the choke thus formed will be further secured by passing the needle three times through it alternately above and below the turns, thereby stitching down the turns round the choke at two points equi-distant from each other.

The cartridges will be made up to their proper lengths and diameters by means of the hoops. The operation is performed as follows:—*With braid hoops* draw the braid through the serge or silk cloth until the knot of the loop comes home to the cartridge, the single end being already passed through the loop from underneath, pass the single end to one side of and under the loop, then draw the loop tight and keep it so by placing the forefinger of the left hand firmly on the loop; bring the running end between itself and the loop, and draw tight the single bend thus formed, *taking care that the bend bites on the loop and not on the single end*, otherwise the knot will slip. The maintenance of the proper form of the cartridge depends on the hooping being thus secured.

After being choked and hooped the ends of the choke will be cut off to a convenient length, which should in no case exceed half the diameter of the cartridge.

Drill Cartridge.

A dummy cartridge is issued for drill purposes. It is made of wood, covered with raw hide, and is of the same dimensions as the 10 lb. cartridge.

Marking Filled Cartridges.

Cartridges will be marked with the nature of the powder they contain. A record of powder used in all cartridges, with maker's name, lot and date of filling, will be marked on the package, and will be kept in a book for reference.

All cartridges issued from store filled will have the initial or monogram of the station at which they are filled stamped on the bottom end.

The cartridges filled by the Royal Artillery will be distinguished by having no initial letter or monogram stamped on them. This order does not apply to cartridges filled by working parties of the Royal Artillery for the Ordnance Store Department.

The following initials and monograms will be used at the several stations mentioned:—

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* If serge cartridges—which will be used up before silk ones are issued—are being filled, the needle will be threaded with three strands of worsted.

Home Stations.

Alderney	A	Dublin	ꝺN	Pembroke	P
Aldershot	A	Edinburgh	E	Sheerness	S
Chatham	C	Fort George	G	Tynemouth	T
Chester	HC	Gosport	G	Upnor	U
Corl	ꝺC	Guernsey	G	Woolwich	W
Devonport	D	Harwich	H		
Dover	VD	Jersey	J		

Foreign Stations.

Barbadoes	B	Hong Kong	HK
Bermuda	B	Jamaica	JA
Cape Town	C	Kingston, Canada	K
Ceylon	C	Malta	M
Gibraltar	GIB	Mauritius	ꝺM
Halifax, N.S.	H	Quebec and Montreal	Q

All cartridges will be very carefully examined and gauged as to length and diameter previous to packing.

Tubes.

Friction, Copper, Long, Mark II.
Friction, Copper, Solid-drawn, Mark I.
Either of these tubes may be used. The latter will supersede the former in future manufacture.

Range Tables for 8-inch R.M.L. Howitzer of 46 Cwt. with Projectile Fitted with Gas-check.

CHARGE, 10 lb.

Range.	Elevation.	Deflection. Left.	Fuze Scales. Sensitive.*		5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range.	Drift.	Time of Flight.
yards.	° ′	° ′			yards.	yards.	yards.	seconds.
400	2 0	0 8	3·4		14·3	0·56	0·9	1·7
500	2 35	0 13	4·4		14·3	0·70	1·8	2·1
600	3 10	0 17	5·4		14·3	0·83	2·8	2·6
700	3 50	0 21	6·4		12·5	0·97	4·0	3·1
800	4 30	0 24	7·5		12·5	1·11	5·3	3·6
900	5 10	0 26	8·6		12·5	1·25	6·6	4·1
1000	5 50	0 29	9·6		12·5	1·39	8·0	4·6
1100	6 30	0 31	10·7		12·5	1·53	9·5	5·1
1200	7 10	0 33	11·7		12 5	1·67	11·0	5·6
1300	7 50	0 35	12·7		12·5	1·80	12·7	6·1
1400	8 35	0 37	13·7		11·1	1·94	14·5	6·6
1500	9 20	0 39	14·8		11·1	2·08	16·4	7·1
1600	10 5	0 42	15·8	Middle.	11·1	2·22	18·5	7·6
1700	10 55	0 44	16·8		11·1	2·36	20·7	8 1
1800	11 35	0 46	17·9		11·1	2·50	22·9	8·6
1900	12 20	0 48	18·9		11·1	2·64	25·2	9·1
2000	13 5	0 50	19·9		11·1	2·78	27·6	9·6
2100	13 55	0 52	21·0		10·0	2·92	30·6	10·2
2200	14 45	0 55	22·1		10·0	3·06	33·7	10·8
2300	15 35	0 58	23·2		10·0	3·20	37·3	11·3
2400	16 30	1 2	24·5		9·1	3·34	41·5	11·9
2500	17 25	1 6	25·7		9·1	3·48	45·5	12·5
2600	18 25	1 11	27·0		8·3	3·61	51·0	13·1
2700	19 25	1 16	28·3		8·3	3·75	57·0	13·7
2800	20 30	1 23	29·7		8·0	3·89	64·0	14·4
2900	21 40	1 29	30·0		7·1	4·03	72·0	15·2
3000	22 50	1 37	31·6		7·1	4·17	81·0	16·0
3100	24 0	1 45	33·4		7·1	4·31	90·0	16·7
3200	25 15	1 53	34·3		6·6	4·44	100·0	17·4
3300	26 45	2 1	36·2	Long.	5·5	4·58	111·0	18·3
3400	28 25	2 10	38·2		5·0	4·72	123·0	19·3
3500	30 15	2 21	40·3		4·5	4·86	137·0	20·4
3600	32 25	2 33	42·6		3·8	5·00	154·0	21·6
3700	35 0	2 51	45·3		3·2	5·13	176·0	23·1
3800	38 15	3 11	48·7		2·6	5·27	204·0	24·9

* This fuze scale also serves for 15 sec. wood time fuze with special priming, the nearest division on the latter being taken.

CHARGE, 9 lb.

Range.	Elevation.	Deflection.	5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	° ′	° ′	yards.	yards.	yards.	seconds.
400	2 10	0 4	12·5	0·56	0·5	1·7
500	2 55	0 12	11·1	0·70	1·7	2·2
600	3 40	0 18	11·1	0·83	3·0	2·7
700	4 25	0 22	11·1	0·97	4·4	3·2
800	5 10	0 26	11·1	1·11	5·8	3·7
900	5 55	0 29	11·1	1·25	7·3	4·2
1000	6 40	0 31	11·1	1·39	8·8	4·7
1100	7 25	0 34	11·1	1·53	10·4	5·2
1200	8 15	0 36	10·0	1·67	12·1	5·8
1300	9 5	0 38	10·0	1·80	14·0	6·4
1400	9 55	0 41	10·0	1·94	16·0	7·0
1500	10 45	0 43	10·0	2·08	18·1	7·6
1600	11 35	0 45	10·0	2·22	20·3	8·1
1700	12 25	0 47	10·0	2·36	22·5	8·7
1800	13 20	0 50	9·1	2·50	25·0	9·3
1900	14 25	0 52	9·1	2·64	27·8	9·9
2000	15 20	0 55	9·1	2·78	30·8	10·5
2100	16 15	0 58	9·1	2·92	34·0	11·1
2200	17 15	1 1	8·3	3·06	37·5	11·7
2300	18 15	1 4	8·3	3·20	41·2	12·3
2400	19 15	1 7	8·3	3·34	45·0	12·9
2500	20 30	1 12	8·0	3·48	50·0	13·6
2600	21 40	1 16	7·1	3·61	55·0	14·4
2700	23 5	1 22	5·9	3·75	61·5	15·2
2800	24 35	1 28	5·5	3·89	69·0	16·1
2900	26 15	1 36	5·0	4·03	77·5	17·1
3000	28 5	1 46	4·5	4·17	88·5	18·1
3100	30 10	1 58	4·0	4·31	102·0	19·3
3200	32 30	2 13	3·6	4·44	119·0	20·6
3300	35 15	2 33	3·0	4·58	141·0	22·0
3400	38 30	2 57	2·6	4·72	168·0	23·7

CHARGE, 8 lb.

Range.	Elevation.		Deflection.		5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	°	′	°	′	yards.	yards.	yards.	seconds.
400	3	5	0	11	10·0	0·56	1·3	2·1
500	3	55	0	18	10·0	0·70	2·5	2·7
600	4	45	0	23	10·0	0·83	3·9	3·3
700	5	35	0	28	10·0	0·97	5·5	3·8
800	6	25	0	31	10·0	1·11	7·1	4·3
900	7	25	0	35	10·0	1·25	8·8	4·9
1000	8	10	0	38	10·0	1·39	10·6	5·4
1100	9	5	0	40	9·1	1·53	12·5	6·0
1200	10	0	0	43	9·1	1·67	14·4	6·6
1300	10	55	0	45	9·1	1·80	16·4	7·2
1400	11	50	0	47	9·1	1·94	18·6	7·8
1500	12	45	0	50	9·1	2·08	20·9	8·3
1600	13	45	0	52	8·3	2·22	23·3	8·9
1700	14	45	0	54	8·3	2·36	25·8	9·5
1800	15	45	0	56	8·3	2·50	28·4	10·1
1900	16	50	0	59	8·0	2·64	31·4	10·8
2000	18	0	1	2	7·1	2·78	34·8	11·5
2100	19	20	1	6	6·6	2·92	38·8	12·2
2200	20	40	1	10	6·6	3·06	43·0	13·0
2300	22	5	1	14	6·3	3·20	47·5	13·8
2400	23	35	1	19	5·9	3·34	53·0	14·7
2500	25	20	1	24	4·7	3·48	59·0	15·6
2600	27	10	1	32	4·5	3·61	67·0	16·6
2700	29	20	1	41	3·8	3·75	76·0	17·7
2800	31	45	1	54	3·5	3·89	89·0	19·0
2900	35	0	2	12	2·6	4·03	107·0	20·6
3000	39	0	2	42	2·1	4·17	135·0	22·5

CHARGE, 7 lb.

Range.	Elevation.		Deflection.		5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	°	′	°	′	yards.	yards.	yards.	seconds.
400	3	25	0	4	9·1	0·56	0·5	2·1
500	4	20	0	14	9·1	0·70	2·0	2·7
600	5	20	0	21	8·3	0·83	3·6	3·3
700	6	20	0	27	8·3	0·97	5·3	3·9
800	7	20	0	31	8·3	1·11	7·1	4·5
900	8	20	0	35	8·3	1·25	8·9	5·1
1000	9	20	0	38	8·3	1·39	10·8	5·7
1100	10	20	0	41	8·3	1·53	12·8	6·3
1200	11	25	0	44	8·0	1·67	14·8	6·9
1300	12	35	0	47	7·1	1·80	17·0	7·6
1400	13	45	0	50	7·1	1·94	19·5	8·2
1500	14	55	0	53	7·1	2·08	22·0	8·9
1600	16	15	0	56	6·3	2·22	25·0	9·6
1700	17	35	1	0	6·3	2·36	28·5	10·4
1800	19	5	1	4	5·5	2·50	32·0	11·2
1900	20	40	1	8	5·2	2·64	36·0	12·0
2000	22	25	1	12	4·8	2·78	40·0	12·9
2100	24	25	1	18	4·2	2·92	45·5	13·9
2200	26	30	1	25	4·0	3·06	52·0	15·0
2300	28	50	1	33	3·6	3·20	60·0	16·2
2400	31	30	1	45	3·1	3·34	70·0	17·6
2500	35	0	2	2	2·6	3·48	85·0	19·2
2600	38	40	2	27	2·3	3·61	106·0	20·8

CHARGE, 6 lb.

Range.	Elevation.	Deflection.	5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	° ′	° ′	yards.	yards.	yards.	seconds.
400	4 30	0 13	7·7	0·56	1·50	2·6
500	5 35	0 22	7·7	0·70	3·00	3·2
600	6 45	0 28	7·1	0·83	4·75	3·8
700	7 55	0 33	7·1	0·97	6·50	4·4
800	9 5	0 38	7·1	1·11	8·50	5·0
900	10 15	0 42	7·1	1·25	10·50	5·7
1000	11 30	0 45	6·7	1·39	12·50	6·4
1100	12 50	0 48	6·2	1·53	14·75	7·1
1200	14 15	0 51	5·9	1·67	17·25	7·8
1300	15 45	0 55	5·5	1·80	20·00	8·6
1400	17 15	0 58	5·5	1·94	22·75	9·4
1500	18 55	1 2	5·0	2·08	26·00	10·2
1600	20 45	1 7	4·5	2·22	29·75	11·1
1700	22 45	1 11	4·1	2·36	33·75	12·1
1800	25 0	1 17	3·7	2·50	38·75	13·1
1900	27 30	1 25	3·3	2·64	44·75	14·3
2000	30 25	1 34	2·9	2·78	52·25	15·6
2100	33 45	1 46	2·5	2·92	62·00	17·1
2200	39 0	2 12	1·5	3·06	81·00	19·3

CHARGE, 5 lb.

Range.	Elevation.	Deflection.	5 minutes' Elevation increases or decreases the Range by	5 minutes will alter point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	° ′	° ′	yards.	yards.	yards.	seconds.
400	5 40	0 31	7·1	0·56	3·5	2·9
500	7 0	0 36	6·3	0·70	5·0	3·5
600	8 20	0 39	6·3	0·83	6·5	4·2
700	9 45	0 41	6·0	0·97	8·0	4·9
800	11 10	0 45	6·0	1·11	10·0	5·6
900	12 45	0 48	5·3	1·25	12·0	6·3
1000	14 30	0 51	4·8	1·39	14·3	7·1
1100	16 15	0 55	4·8	1·53	16·8	8·0
1200	18 25	1 0	3·8	1·67	20·0	9·0
1300	20 35	1 5	3·8	1·80	23·5	10·0
1400	23 0	1 10	3·5	1·94	27·5	11·0
1500	26 0	1 17	2·8	2·08	32·5	12·2
1600	29 30	1 28	2·4	2·22	39·5	13·7
1700	33 30	1 41	2·1	2·36	48·0	15·3
1800	39 0	2 2	1·5	2·50	61·0	17·4

CHARGES, 4 lb.

Range.	Elevation.	Deflection.	5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	° ′	° ′	yards.	yards.	yards.	seconds.
400	8 0	0 45	6·3	0·56	5·0	3·5
500	9 30	0 46	5·6	0·70	6·5	4·2
600	11 10	0 49	5 0	0·83	8·3	4·9
700	13 0	0 52	4·5	0·97	10·2	5·6
800	15 0	0 56	4·2	1·11	12·4	6·4
900	17 20	1 0	3·6	1·25	15·0	7·4
1000	20 0	1 4	3·1	1·39	18·0	8·5
1100	23 0	1 12	2·8	1·53	22·0	9·7
1200	27 15	1 24	2·0	1·67	28·0	11·3
1300	32 0	1 36	1·7	1·80	35·0	13 0
1400	38 15	1 58	1·3	1·94	45·0	15·2

CHARGE, 3 lb.

Range.	Elevation.	Deflection.	5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	° ′	° ′	yards.	yards.	yards.	seconds.
400	10 45	1 8	3·8	0·56	7·5	4·0
500	13 50	1 8	3·5	0·70	9·3	4·9
600	16 15	1 10	2·9	0·83	11·6	5·9
700	19 30	1 15	2·6	0·97	14·5	7·0
800	23 45	1 22	2·1	1·11	18·2	8·4
900	29 0	1 33	1·6	1·25	23·2	10·2
1000	38 0	2 0	0·9	1·39	33·2	12·9

CHARGE, 2 lb.

Range.	Elevation.	Deflection.	5 minutes' Elevation increases or decreases the Range by	5 minutes will alter Point of Impact vertically or laterally at each Range	Drift.	Time of Flight.
yards.	° ′	° ′	yards.	yards.	yards.	seconds.
400	18 15	1 42	2·00	0·56	11·0	5·4
500	24 0	1 44	1·44	0·70	14·5	6·9
600	35 0	2 12	0·75	0·83	22·0	9·6

DRILL.

Travelling Carriage fitted with Hydraulic Buffer.

The detachment consists of 10 Nos., and falls in two deep. It is told off, marched into the battery, and halted in line, facing the parapet and to the left rear of the platform. It is now in the position of "detachment rear."

To Take Post under Cover.*

Officer.	*No. 1.*
Take post under cover.	*Right turn.* *Double march.*

The detachment wheels to its left, the front rank filing to the left of the gun, the rear rank to the right; 2 and 3 halt close to the

* If the howitzer is not behind a parapet, and the word of command is "*Take post at the gun*," the detachment wheels to its left as before, 2 and 3 halt in line with the front of the wheels; 4 and 5 with the rear of the wheels, No. 1 in rear of the gun, 6, 7, 8, 9, and 10 at the limber.

parapet on the right and left of the platform; 4 and 5 form up on their right and left, and the whole turn to the right about together. No. 1 follows in rear of the detachment, keeping under cover as much as possible; 6 and 8 going to the cartridge store: 7, 9, and 10 to the shell store.

General Duties.

No. 1 commands, directs, or superintends boring and fixing fuzes, assists to run up, and lays.

No. 2 searches, sponges, lifts projectile, rams home, runs up, and traverses.

No. 3 loads, lifts projectile, uncaps or removes safety-pin from fuze when in bore, rams home, runs up, and traverses.

No. 4 attends to side arms and supplies them to 2, runs up, and elevates.

No. 5 attends to vent, supplies 3 with automatic gas-checks, runs up, makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes and brings up projectiles in bearer, and assists to lift them to the muzzle.

No. 8 attends to cartridge store, and serves out cartridges to 6.

No. 9 assists 7.

No. 10 attends to shell store, issues shells, tubes, and fuzes.

To Prepare for Action.

Officer.	*No. 1.*
Prepare for Action	*Prepare for Action.* *Examine gun.*

"*Prepare for action.*"—The stores are brought up as follows:

No. 1, handspike and sights.

No. 2, handspike, and assists 4 with side arms.

No. 3, handspike, removes the tampeon from muzzle.

No. 4, handspike, side arms, and support for head of side arms.

No. 5, handspike, tubes in pocket, lanyard, pricker, and vent server.

No. 6, two cartridge cases, which he leaves at the cartridge store, bucket filled, and brush. For drill purposes two drill cartridges.

No. 7, fuzes and fuze and shell implements. He obtains the fuze boxes from 10, having ascertained from No. 1 the fuzes required; and satisfies himself as to the correctness of fuzes and fuze implements. He places the fuze boxes on the shell benches in the covered way on left of gun portion where the shells are fuzed.

No. 8 prepares to issue cartridges.

No. 9 provides a brush and shell bearer, also automatic gas-checks in box with lid unscrewed. No. 10 prepares to issue shells, friction tubes, and fuzes. He examines the shells carefully, cleaning them if necessary; he loosens the fuze-hole plugs of shells that will be first issued.

The stores having been brought up, No. 1 will satisfy himself that the foresights fit properly on the gun and the horizontal bars of the sights work easily; he receives the reports from the Nos. responsible

of any irregularity or deficiency in connection with the gun, ammunition, or stores.

The sponge, rammer, and wadhook are laid on the ground clear of the platform, to the right of the gun and parallel to it, heads to the rear, resting on the support supplied by 4, sponge nearest the gun. The sponge bucket near the sponge head.

The handspikes are laid down, two on each side of the gun close to the carriage, points to the front, bevelled side uppermost, those of 2 and 3 outside, and about 2 feet in advance of those of 4 and 5. No. 1's handspike in rear of the platform.

No. 3 examines the bore to see the grooves are free from grit, &c.

No. 4 ascertains that the elevating gear is in working order (should the elevating arc have been detached from the carriage he brings it up and adjusts it).

No. 5 straps the tube pocket round his waist on the right side, coils up the lanyard, and passes the bight of it through the tube pocket strap; examines the vent server, and places it in the vent, the loop of the vent server lanyard over one of the sights; he fills his tube pocket with friction tubes, which he procures from 10, and places the pricker in the loop on the carriage, and sees that the automatic gas-checks are placed in a convenient position.

N.B.—Should the stores be on the gun, they are unstrapped and laid down as above detailed.

"*Examine gun.*"—No. 5 drifts the vent, replaces the pricker in the loop and the vent server. 2 supplies himself with the wadhook, searches the gun after the pricker has been withdrawn, and replaces wadhook. 4 attends to the elevating wheel to bring the gun into a convenient position for loading.

To Load.

Officer.	*No.* 1.
Range—Yards.	*With—Load.*
With—Load.	

"*Load.*"—No. 1 gives 7 the nature of shell and fuze required, and during the loading fixes his tangent scale at the required elevation. He places himself in a convenient position, near the muzzle, whence he can watch the loading, and observe by the mark on the rammer if the shell is home.

No. 2 places himself in a convenient position for sponging. He places his left foot in line with and about 12 inches from the muzzle, steps to his right with his right foot, and looks to his left rear, takes the sponge in a horizontal position from 4, left hand back down, right hand back up, brings it in line with the axis of the gun, enters the head into the bore, being careful to observe that the vent server is in the vent, slides his hands along the stave to his right as far as he can reach, sends the sponge up the bore, slides his hands out again and forces the sponge hard home, gives it two half turns, pressing it against the bottom of the bore, withdraws the sponge hand over hand, turning it from him, cleaning the bore well. When the sponge arrives near the muzzle, he jerks it out, his hands should then be in the position they were in when he introduced the sponge into the bore. He then hands the sponge to 4 and assists 3, 7, and 9 to lift the projectile and place it in the bore, receives the rammer, right

hand about the centre back down, left as near the head as possible back up; as soon as the cartridge and shell are put in, he enters the head into the bore, and forces them home hand over hand. He then springs the rammer, steps out, hands it to 4, and goes under cover.

No. 3, as soon as the sponge is withdrawn, takes the cartridge from the cartridge case with his left hand, moves up and places it in the bore, receives a gas-check from 5 and places it in the bore immediately in front of the cartridge, painted side to the rear; he then assists 2, 7, and 9 to lift the projectile and place it in the bore, withdraws the safety pin, or uncaps the fuze, places himself in a corresponding position to 2 and assists him to ram home; when the cartridge and projectile are home he quits the stave and goes under cover.

No. 4 doubles out, halts in line with the sponge head, turns to his left, picks up the stave with his right hand back under, 6 inches from the head, turns three-quarters left about, and in doing so lifts the sponge over his head, allowing the end of the stave to rest on the ground. His left hand meets the stave close to the sponge, his right hand is slipped up the stave about two feet. He then moves towards the muzzle and places the sponge in a convenient position for 2 to lay hold of, waiting for its return at the left rear of 2, facing the gun. When he receives the sponge from 2, he allows the end of the stave to fall on the platform, steps to the left, turns three-quarters right about, passing the sponge over his head, lays it down, takes up the rammer as before detailed for the sponge, and hands it to 2. He then remains in position to receive the rammer as soon as 2 has sprung it. He lays it down as he did the sponge and goes under cover.

No. 5 hands a gas-check to 3.

No. 6 brings up a cartridge in a case and places it on the ground on 3's right front; after the sponge is withdrawn he uncovers it, and as soon as 3 has withdrawn the cartridge, 6 takes the case back to the cartridge store.

Nos. 7 and 9 bring up a shell in bearer, having fixed the fuze according to No. 1's direction, and, assisted by Nos. 2 and 3, place it in the bore. No. 9 removes the empty shell-bearer.

No. 8 issues a cartridge to 6.

No. 10 issues a shell to 7 and 9.

To run up.

Directly the gun is loaded, No. 1 gives "*Run up.*"

Nos. 2, 3, 4, 5 takes up their handspikes; 2 and 3 apply theirs horizontally over the spokes of the wheels in front, and under the bracket, close to the breast, and bear down; 4 and 5 use theirs as levers of the second order under the rear part of the wheels. All four numbers face to the rear.*

When the gun is run up, No. 1 gives "*Halt,*" slides his handspike to the rear clear of the recoil, and looks over the sights, steadying himself by leaning on the cascable. 2 and 3 go to the end of the trail facing to the rear ready to traverse, 4 and 5 lay down their handspikes, 4 goes to the elevating wheel; 5 prepares a tube.

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* Running back at Drill is the converse of the preceding.

To Lay the Howitzer.

Officer.	*No. 1.*
	Elevate.
	Depress.
	Halt.
	Trail right.
	Trail left.
	Halt.

At "*Elevate*" or "*Depress*," 4 turns the wheel in the required direction till the word "*Halt.*"

At "*Trail right*," 3 heaves over the trail, at "*Trail left*" 2 till the word "*Halt.*"

At "*Extreme right or left*," 2 and 3 apply their handspikes, and with 4 and 5 heave over the trail; when it is necessary to shift the trail plank, 2 and 3 place the points of their handspikes under the trail and raise it; 4 double-mans 2's handspike, 1 and 5 shift the plank.

If it is necessary to run the gun back, at "*Run back*" 2 and 3 apply their handspikes in front of the wheels, using them as levers of the second order: 4 and 5 take a purchase with theirs over the most horizontal spokes in rear and under the brackets; the whole facing to the rear.

Should no order to fire be given when the gun is laid, No. 1 gives the order "*Under cover.*"

To Make Ready and Fire.

Officer.	*No. 1.*
Fire—Rounds.	*No.—Ready.*
	No.—Fire.

No. 1 lowers his tangent scale and gives "*Ready;*" 5 presses the tube into the vent with his right thumb, steps clear of the recoil, shifts the lanyard to the right hand and extends it, keeping his hand level with the vent, facing the gun.

As soon as "*Ready*" is given, 2 and 3 lay down their handspikes and with 4 go under cover.

At "*Fire*" 5 draws the lanyard strongly towards his body, without a jerk; he then drifts the vent, replaces the vent server, and goes under cover.

No. 1 does not again give "*Load*" until 5 has replaced the vent server.

When the charge is below 6 lbs., up to 30° elevation may be given; when the charge is 6 lbs. or over not more than 20°.

Drill for Howitzer on Bed.

The drill is the same as for howitzers on travelling carriages with the following exceptions:—

The recoil is checked by means of an iron plate compressor. No. 1 sets the adjusting lever, with a view to obtaining as much

recoil as possible and thus taking the strain off the pivot bolt. He must take care that the directing bar is central so that the compression on each side is equal when the compressor handle is put down.

5 attends to the compressor lever. He throws it up after recoil, and puts it down below the catch as soon as the howitzer is run up and before it is laid. It is liable to throw the howitzer out of line if put down after the latter is laid.

To run up.—4 hooks a drag-rope to the eye-bolt in the breast transom. It is manned by the whole detachment. It will be found advantageous to use tackle instead of a drag-rope when possible.

To Load.—The howitzers are loaded in the firing position.

To traverse.—2 and 3 are supplied with iron-shod lever instead of handspikes. They apply them under the horns of the directing bar.

To lay.—The howitzer being mounted in the rear of a high parapet, the object fired at cannot be seen over the sights. One of the methods of laying described at page 4 must therefore be adopted.

Howitzers on bed not to be fired at less than 20° elevation on account of the strain on the pivot. Extreme elevation 40°.

Instructions for the Disablement or Destruction of Guns by Means of Guncotton.

The Destruction of Heavy Guns when Time is immaterial.
The Hasty Disablement of Siege Guns.

The Destruction of Heavy Guns when Time is immaterial.

This duty will be performed by the Royal Artillery, the stores marked (*a*) in the following list being obtained from the Royal Engineers; and the remainder taken from the siege train equipment.

The materials required are as follows:—

(*a.*) Guncotton (1 lb. slabs), perforated to receive a dry primer; 2 slabs for each charge, and spare slabs at the rate of 2 spare for every 5 (or less number) of guns to be destroyed.

The "guncotton wet slabs, 2 perforations," mentioned in List of Changes, § 4883, are cut in half to form these 1-lb. slabs. They are issued wet, and arrangements are made for so keeping them, but it is immaterial whether they are wet or dry when required for use.

(*a.*) Guncotton primers, dry, weighing 1 oz., 1¼ inch diameter, coated with paraffin; 1 primer for every two slabs.

Bags, waterproof, to contain 2 lbs. of guncotton, 1 for every 2 slabs carried.

(*a.*) Exploder, dynamo-electric, quantity.

(*a.*) Solution, indiarubber, in tin cylinder.

(*a.*) Twine, stout, 1 lb.

This is sufficient for about 20 charges.

(*a.*) Detonators, No. 13, in a cylinder containing 25 detonators, with a rectifier.

Each cylinder will suffice for 20 charges, with 5 spare detonators.

(*a.*) Wire, insulated, lengths of 40 yards each.

Five additional yards are required for each charge after the first operation, to replace the wire blown away by a discharge.

Tackle and selvagees, with rollers, skidding, handspikes, &c., for lowering the gun into a pit, or up-ending it under the branch of a tree.

The exact proportion of these cannot be given. It will depend upon the size of the guns to be destroyed, upon local circumstances, &c.

Directions for Carrying Out the Operations.

Plug up, with a peg of wood, the vent of the gun to be disabled, driven well in so as to make the vent watertight.

Up-end the gun on its breech, either by digging a pit for its reception, or by other convenient means.

The Officer in charge of the operations must be guided by local circumstances, but the more the gun is raised vertically on its breech the better.

Clean the terminals of the insulated wire, and of the wires attached to the detonators, by scraping. The detonator is then to be connected with the insulated wires. To secure perfect electrical circuit the junctions must be insulated from each other by smearing them over with indiarubber solution, and wrapping them with tape (indiarubber or calico).

Insert the detonator, after securing it to the wires, into a dry primer, first using the rectifier to ensure the hole in the primer being of a proper size to admit the detonator, which should be sent home to the head.

On no account whatever should a detonator be twisted or roughly forced into a primer.

Insert the dry primer, fitted with detonator, into the perforation in one of the 1 lb. slabs, pushing it gently in until the hole in the slab is quite filled by it.

Place the slab thus prepared, together with another slab, in a waterproof bag.

Choke the neck of the bag with twine closely round the insulated wires; plaster the inner portion of the choke round the wires with the indiarubber solution, and choke again round and above the solution so as to make the whole as watertight as possible.

Attach to the wires a small sinker of any heavy material, so that its weight comes on them above the choke. The sinker should be small in bulk, so as to allow the charge to settle home to the bottom of the bore; and, when hanging freely from its point of support, it should be just below the bottom of the bag.

Attach to the choke a piece of stout twine long enough to reach to the bottom of the bore of the gun, and lower the charge by it carefully to the bottom of the bore, paying out the insulated wires at the same time, and taking care that no strain comes on them.

In operating upon guns of the heavier natures, it is advisable, in order to ensure their destruction, to employ two charges, to be fired simultaneously in different parts of the gun's bore. These charges should be prepared as directed, and should then be firmly attached to a stick of such length that, when inserted into the gun, one of the charges should be at the breech of the gun while the other should be just above the trunnions. One of the wires from the exploder should be attached to the detonator in the lower charge, the other wire from the exploder being attached to one of the wires of the detonator in the upper charge. The other wires of the detonators should be connected together by a piece of insulated wire. The whole of the connections must be carefully insulated.

(The sinker, which should be attached to the stick, or the lower charge, must be sufficiently heavy to prevent the charges floating.)

Fill up the bore with water; connect the free ends of the insulated wires with the binding screws of the exploder, and, after seeing that all is clear, fire the charge by turning, or pressing down, sharply the handle of the exploder.

This should be done immediately after lowering the charges into the gun, so as to give the water as little time as possible to effect an entrance into the bag.

The operator should be careful to place himself and his party under cover, and the terminals of the conducting wires are not to be connected to the exploder until all present have placed themselves under cover.

In the event of a detonator failing, at once disconnect the wires from the exploder. The charge must then be taken up and re-made, with a fresh detonator. Great caution must be exercised in slowly extracting the detonator from the primer.

Cautions.

Care should be taken to see that the insulation of the wire is perfect, that the connections are clean and good, and that they are afterwards thoroughly insulated, according to the directions given.

If any part of the wire is accidentally denuded of its insulation, prop up the adjacent insulated portion, so that the bared portion will not touch the ground. If time allows, it is better to wrap the defective place thoroughly in indiarubber tape.

Detonators by themselves must always be handled with the greatest care and freedom from rough usage, and still more so when they are fitted into guncotton. The latter by itself is harmless.

Immediately after an explosion, detach the wires from the exploder, and do not re-attach them till just before firing the next charge, as directed.

The Hasty Disablement of Siege Guns.

The hasty disablement of siege guns will be carried out by the Royal Artillery.

STORES REQUIRED.

The necessary supplies of guncotton for the disablement of siege guns will be obtained from the Royal Engineer Siege Park.

The following stores will be carried with each unit of the Siege Train :—

Boxes ..	guncotton, slabs*	1—½ slab	8
		8—½ slabs	1
	stores, disabling, ordnance, siege		1
	vesuvian matches..		1
Cases ..	detonator, for 8†		2
	guncotton, primers†		2
	guncotton slabs†		4
Cylinders	detonator, No. 8, for 8		2
	guncotton primer, dry, 1¼ in. × 1¼ in., for 8..		2
Detonators, No. 8			16
Guncotton	dry primers, 1 perforation, 1¼ in. × 1¼ in. ..		16
	wet slabs, 2 perforations, 6⅝ in. × 6⅝ in. × 1⅜ in.		8‡
Pouches, match-box†			1
Rectifiers, guncotton primers			2
Twine, choking, 3-thread .. .. pieces			1

Instructions for carrying out the Operations.

In the case of guns of 64-pr. and larger calibres two slabs must be employed.

Insert a detonator into a dry primer.

On no account should a detonator be twisted or roughly forced into a primer.

Insert the dry primer fitted with detonator into the perforation in one of the slabs, pushing it gently in until the hole in the slab is quite filled by it.

Tie a piece of twine round the detonator, pass the ends round the slab, and then tie them together; the object being to prevent the primer slipping out of the slab.

Place the slabs lengthways on the chase, their long sides touching, about a foot from the muzzle. Tie them on tightly with twine to prevent them slipping, from wind or other disturbing cause.

The exact position must depend on the form of the gun. The great thing is to have as much of the surface of the cotton *in actual contact* with the gun as possible. Hence the slabs should not ride on an astragal or moulding, but should always be placed on a plain part of the chase.

Observe the direction of the wind, and arrange the slab containing the detonator so that the tail of the safety fuze is away from the slab and to leeward of it. This is to lessen the chance of a spark igniting the guncotton before the detonator is fired, in which case, in all probability, no effect whatever would be produced on the gun.

If projectiles belonging to the gun are available, and time allows, it is advisable to ram one up the bore; so that when the gun is dented by the explosion it may be imprisoned there and prevent the gun from being used even to fire a bag of bullets.

Tear or cut the little calico cap off the end of the safety fuze and ignite the fuze by the vesuvian matches provided, or other con-

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* Copper tinned.

† Leather.

‡ In half slabs, 1 perforation in each.

venient means. An ordinary flame does not readily ignite it. The fuze ignites most easily when cut obliquely with a sharp knife.

Retire under cover, and await the explosion. The length of safety-fuze will burn about 45 seconds.

Should circumstances permit, the effect of the detonation will be increased by placing a filled sand bag or a sod of turf on the gun-cotton, when lashed in position on the chase. Great care should be taken in this operation not to strike or bend the detonator.

It is also advisable, after the explosion, to try if the gun is so dented as to prevent loading. If the dent is not sufficient, the operation should be repeated, putting the fresh slabs in the same place as the first.

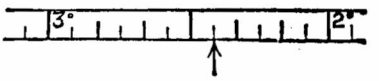
Caution.

Never roughly bend or kink the safety fuze. If it has apparently gone out without firing the detonator, allow at least half-an-hour to elapse before meddling with it, if time will admit, but if not, the greatest care must be taken in touching it, to avoid accident by a "hang-fire."

Instructions for Use of Watkin's Clinometer.

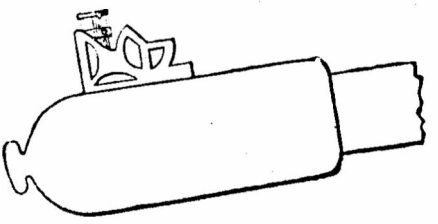
To read the angles marked on the drum.—The brass drum is marked in degrees, commencing at 0° on the top to 45° at the bottom. Each degree is subdivided into twelve parts; each small division therefore represents angles of 5 minutes.

The scale is read from right to left, thus—

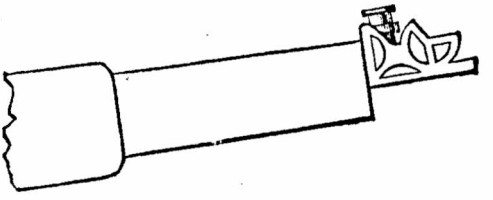


the reading opposite the arrow would indicate an angle of 2° 25′.

To lay a gun or howitzer at any angle up to 45°.—Unscrew the drum until the ↑ points to the elevation required, place the clinometer, thus—

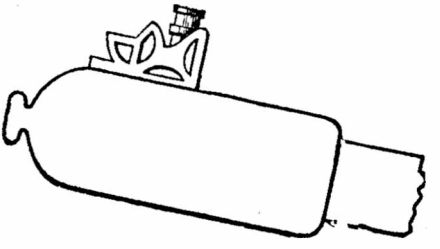


on the plane surface cut on the breech, or against the muzzle, thus —

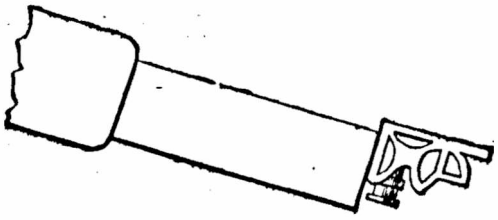


and elevate the piece until the bubble of the spirit-level is in the centre of the tube.

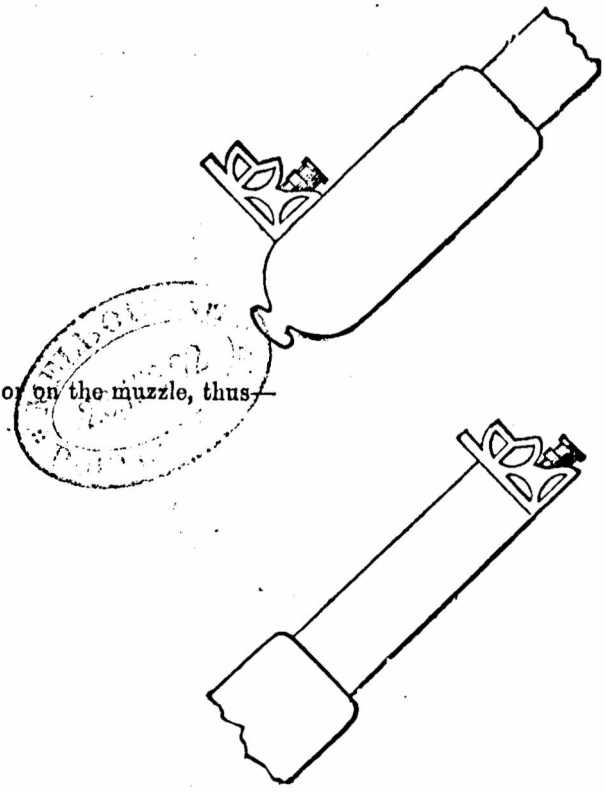
For angles of depression.—Proceed as above, but reverse the direction of the instrument, placing it thus on the breech of the gun—



and thus on the muzzle—



For angles of elevation greater than 45°.—Subtract the angle of elevation required from 90°, unscrew the drum to this reading; thus, for 60°, unscrew the drum to 30°, and place the instrument on the breech of the gun, thus—



or on the muzzle, thus—

and elevate until the bubble is in the centre of its run.

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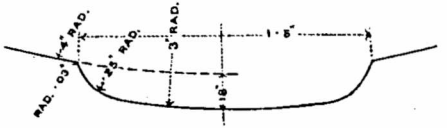
(Wt. 7268 450 7 | 90—H & S 4746)

ORDNANCE R. M. L. 8 INCH HOWITZER 46 CWT MARK I.

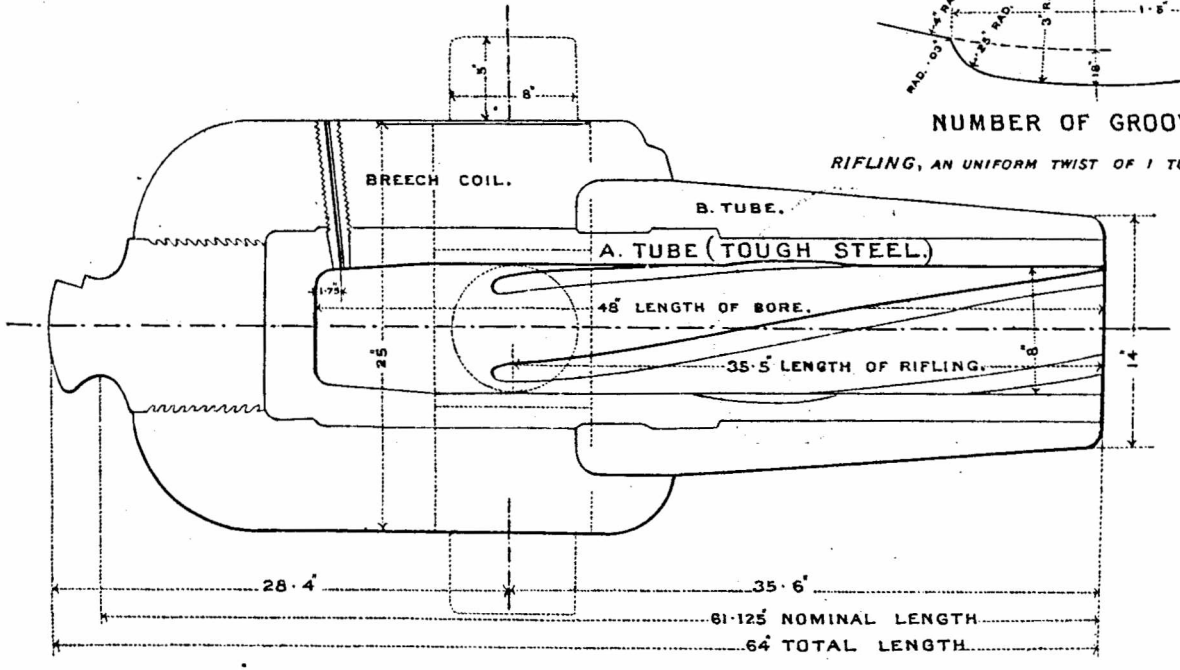
STEEL & WROUGHT IRON.

SECTION OF GROOVE.
FULL SIZE.



NUMBER OF GROOVES 4.

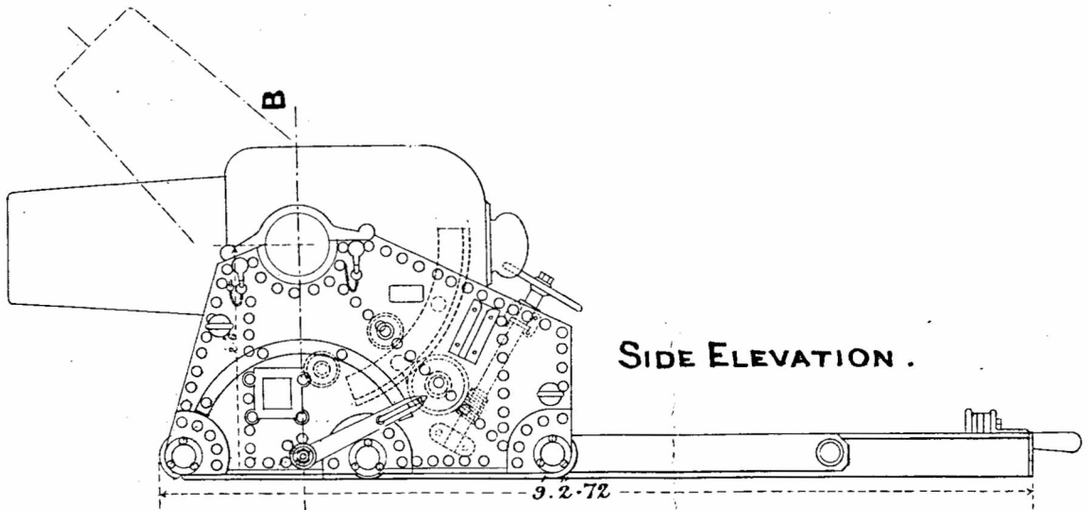
RIFLING, AN UNIFORM TWIST OF 1 TURN IN 16 CALIBRES.



Judd & Co Ltd Lith. 73 & 75, Farringdon Rd & Doctors Commons. 1883. 7. 90.

A21

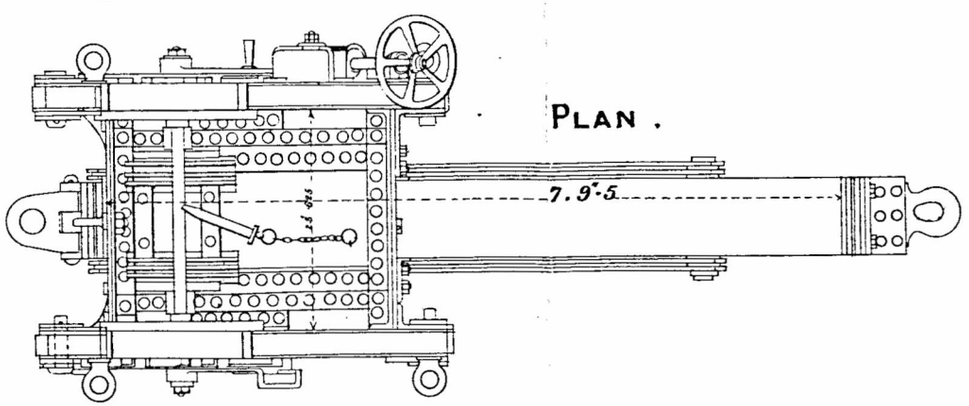
BED, HOWITZER R.M.L. 8 INCH, 46 CWT.



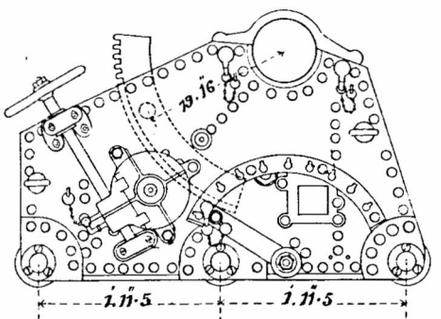
SIDE ELEVATION.

GUIDE BAR. ELEVATION.

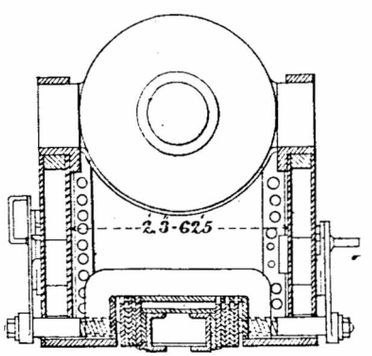
PLAN.



PLAN.



SIDE ELEVATION. (RIGHT SIDE.)



SECTIONAL ELEVATION THROUGH A. B.

SCALE

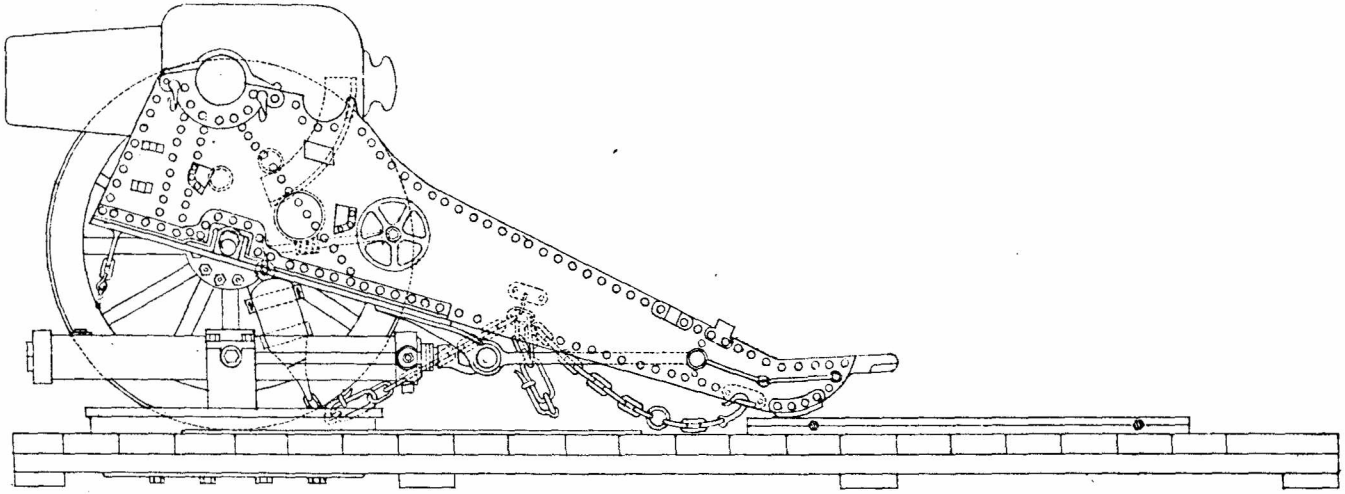
Inches 3 6 3 0 1 2 3 4 5 6 7 Feet.

Judd & Co Ltd Lith. 73 & 75, Farringdon Rd & Doctors' Commons 1103. 2/90.

Plate III.

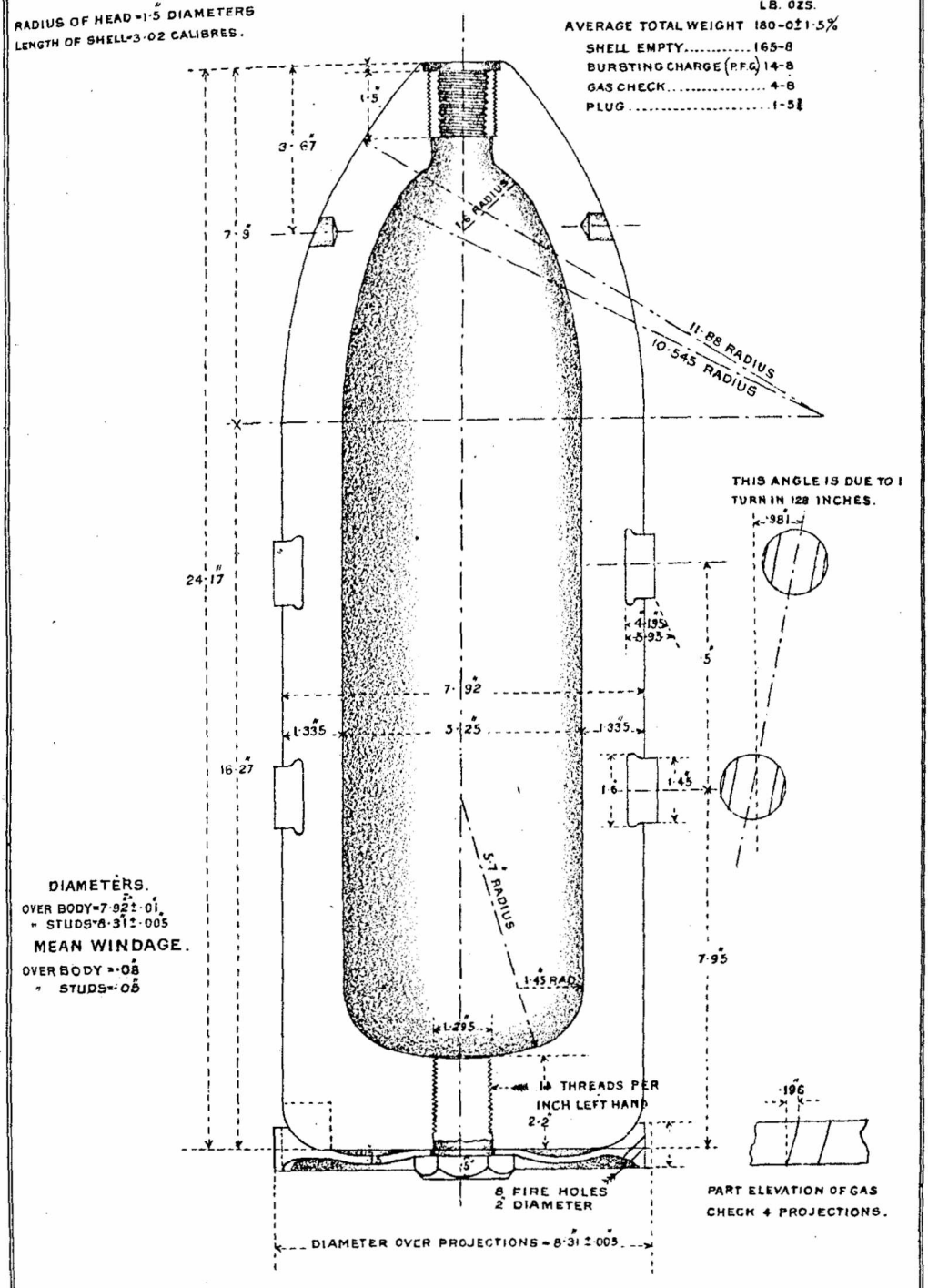
CARRIAGE, SIEGE, R.M.L. 8 IN. 46 CWT HOWITZER.

CENTRAL PIVOT, MARK I.



Judd & Co Ltd Lith. 73 & 75, Farringdon Rd & Doctors' Commons. 1003. 7/90.

SHELL R.M.L. HOWITZER COMMON 8 INCH 46 CWT MARK II.



Judd & Co Ltd Lith 73-75 Southgate Rd N

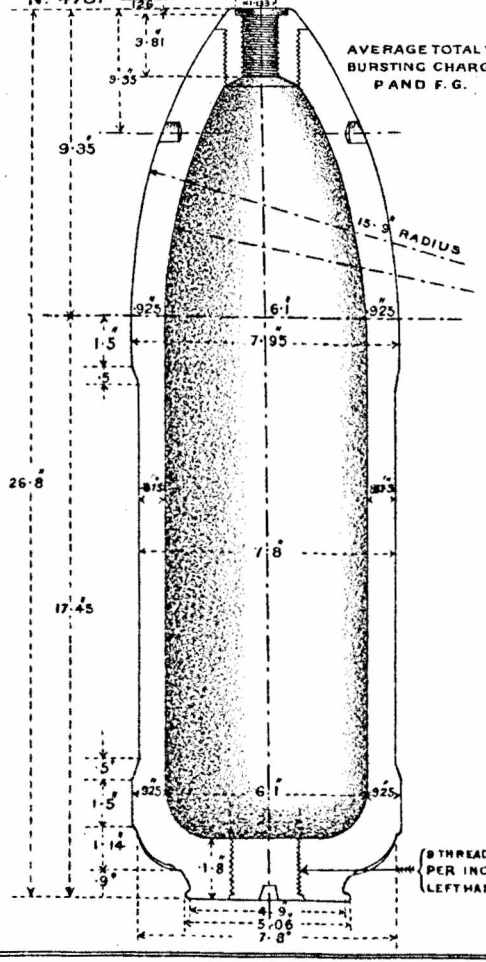
SHELL R.M.L. SHRAPNEL 8 INCH HOWITZER I.

CAST STEEL, FOR 46 AND 70 CWT HOWITZERS.

SHELL R.M.L. COMMON 8 INCH HOWITZER CAST STEEL III.
FOR 70 AND 46 CWT HOWITZERS.

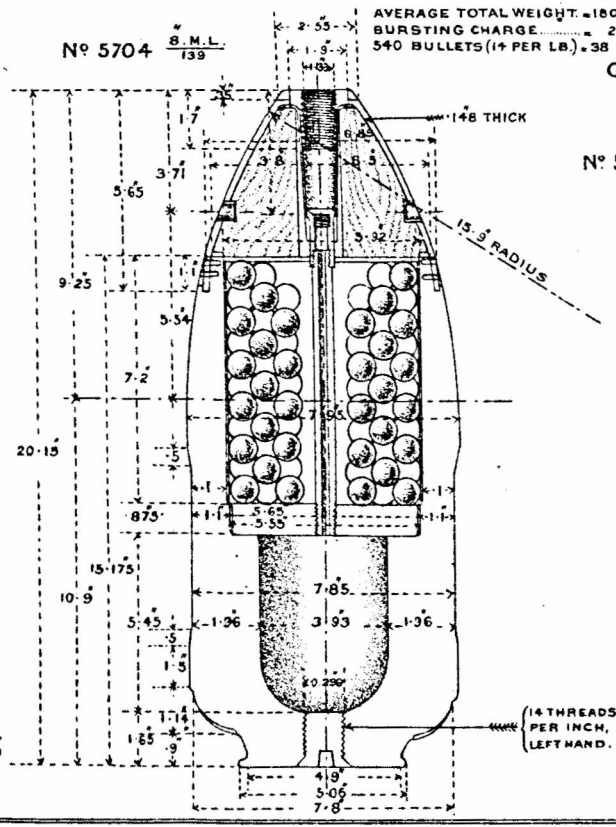
Nº 4781 B.M.L. 126

LB. OZ.
AVERAGE TOTAL WEIGHT = 180. 0± 2%
BURSTING CHARGE..... = 25 . 15
P AND F.G.



Nº 5704 8 M.L. 139

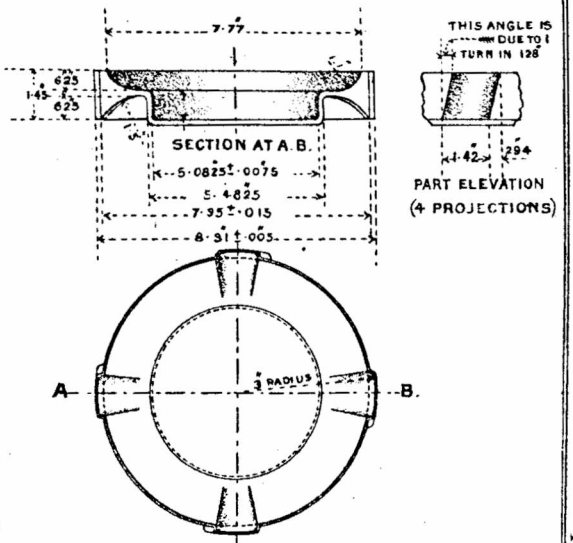
LB. OZ.
AVERAGE TOTAL WEIGHT = 180. 0± 2%
BURSTING CHARGE..... = 2. 0
540 BULLETS (14 PER LB.) = 38 . 0



GAS CHECK R.M.L. 8 INCH HOWITZER 46 CWT AUTOMATIC I. COPPER.

Nº 5731 M 1749

LB. OZ.
WEIGHT 7· 6± 6 OZS.



INVERTED PLAN.

Plate V.

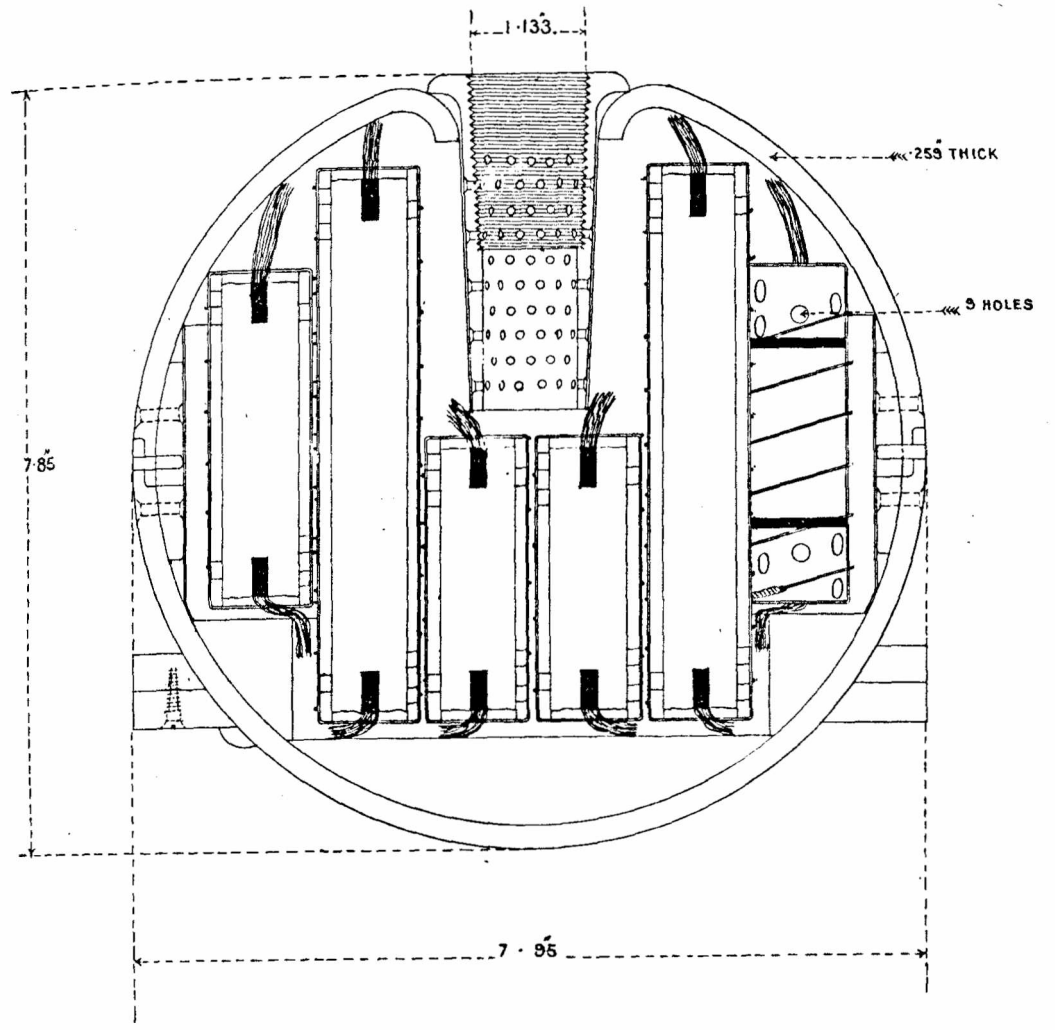
Hudson & Co. Ltd. Lith. 73 & 75, Farringdon Rd.

Nº 6040 8" M.L. / 143 (REDUCED)

SHELL R. M. L. FILLED STAR, 8 INCH. MARK IV.

SPHERICAL.

SCALE $\frac{1}{2}$.



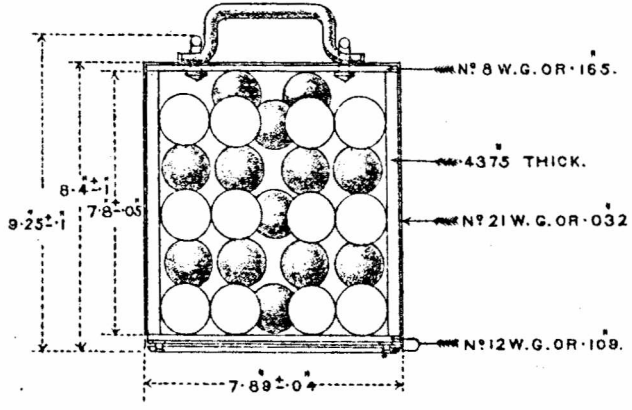
SHOT R. M. L. CASE 8 INCH. MARK III.

FOR GUN AND HOWITZER 70 CWT AND 46 CWT.

SCALE 1/6.

LENGTH OF SHOT = 1·05 CALIBRES.

	LB	OZS
AVERAGE TOTAL WEIGHT	74 .	0 ± 2½ LB.
CASE	28 .	1½
CLAY AND SAND	9 .	8
SAND SHOT (8 OZ)	36 .	7½

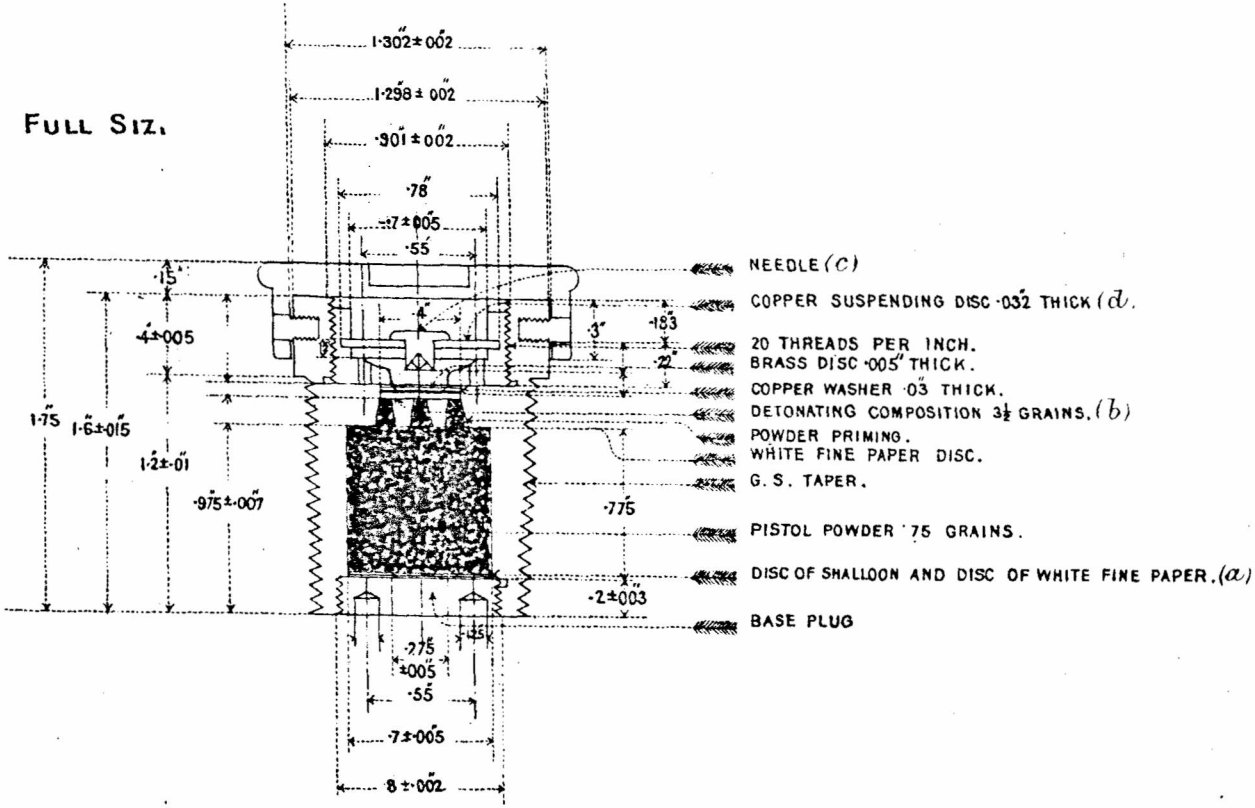


Judd & Co. Lth. 73 & 75, Farringdon Rd & Doctors Comms 1903. 2. 90.

FUZE, PERCUSSION, DIRECT ACTION, Nº 3. MARK II.

METAL 5 IN A TIN CYLINDER.

FULL SIZ.

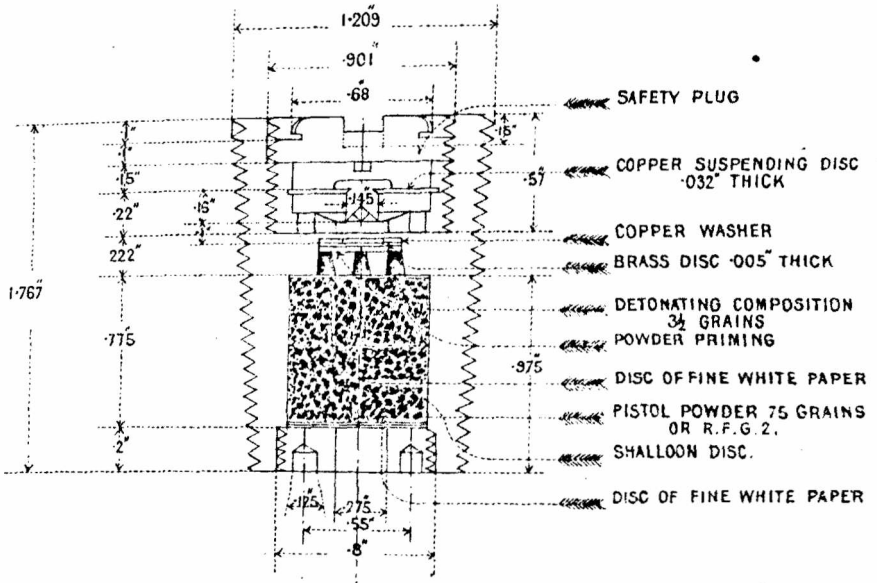


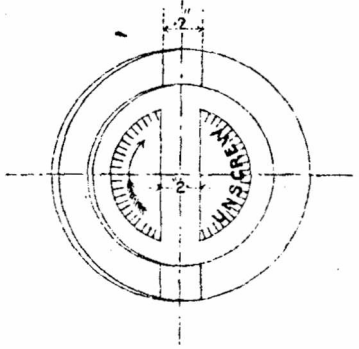
Judd & Co. Ltd. Lith. 73 & 75, Farringdon Rd. & Dartmouth Commons. 1903. E. / 20

FUZE, PERCUSSION, DIRECT ACTION No. 3. MARK III

METAL 5 IN A TIN CYLINDER.

FULL SIZE.





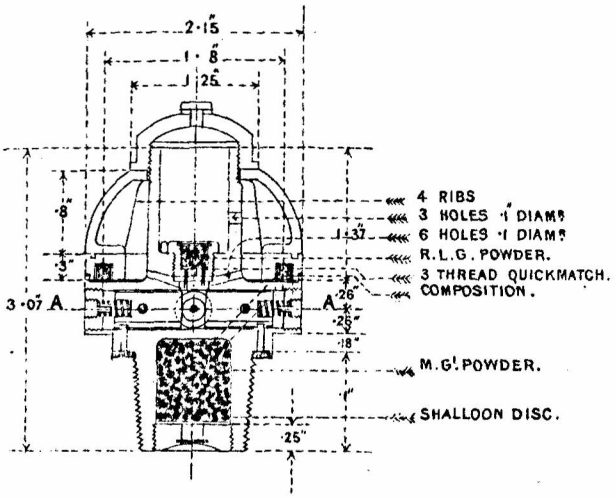
PLAN

Judd & Co Ltd Lith. 73 & 75, Farringdon Rd & Doctors' Commons.

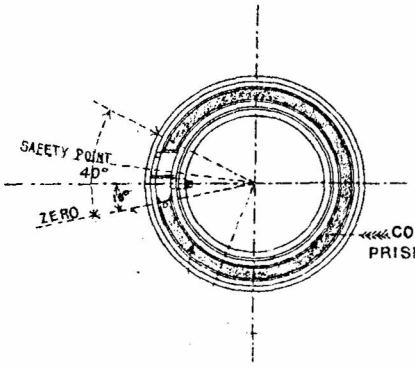
FUZE, TIME, SENSITIVE, LONG, N°23. MARK I.

METAL I IN A TIN CYLINDER.

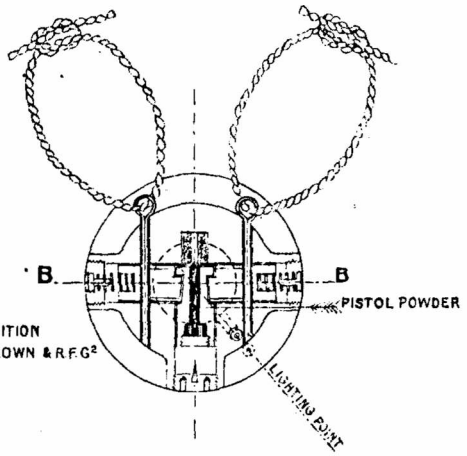
HALF SIZE.



SECTION AT B.B.



PLAN OF RING INVERTED.

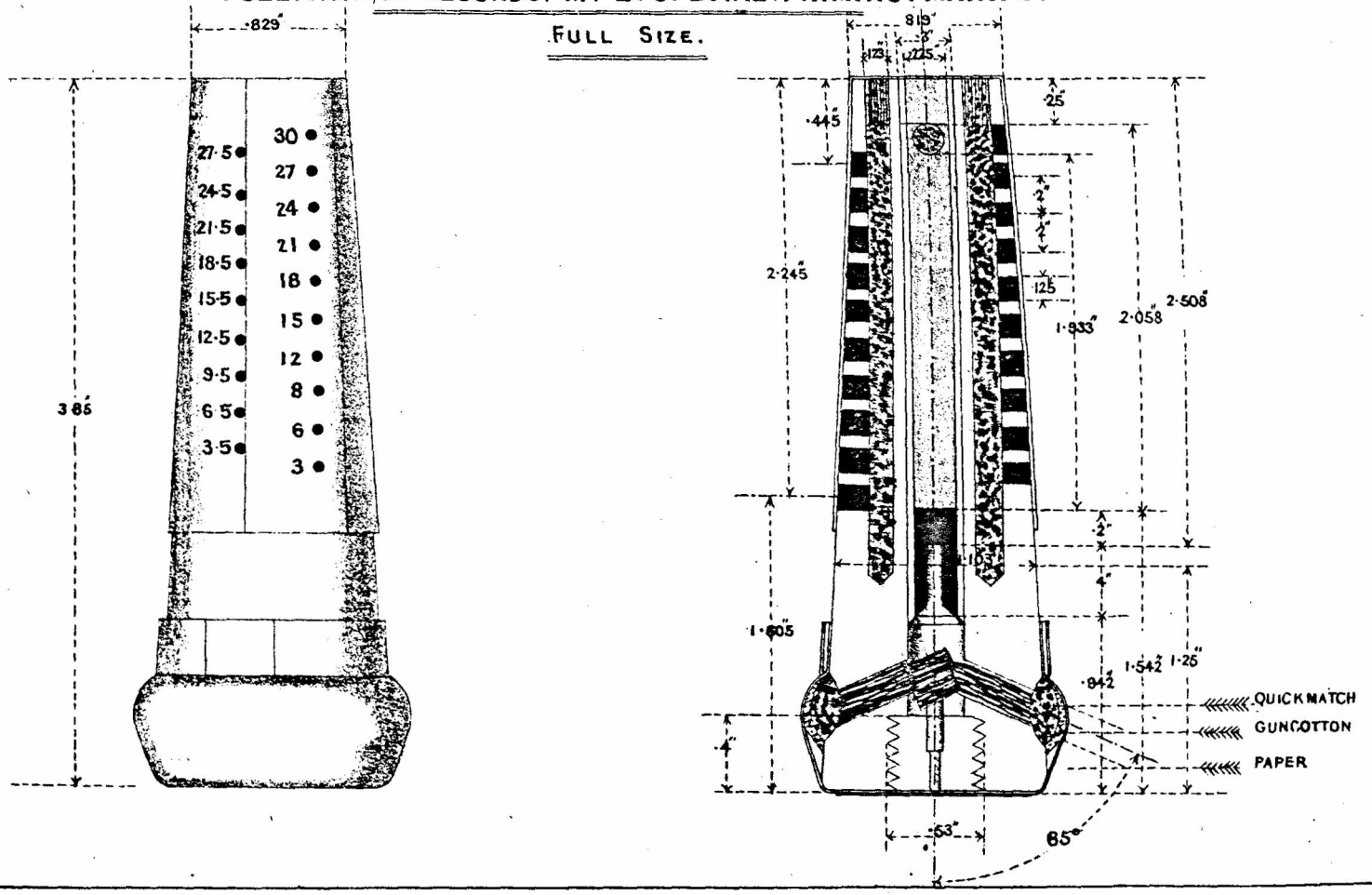


SECTION AT A.A.

Judd & Co Lte Lith. 73 & 75. Farringdon Rd & Doctors' Commons. 1403.7/90.

FUZE. TIME, 15 SECONDS. M. L. SPECIAL. PRIMING. MARK I.

FULL SIZE.



Judd & Co. Ltd. Lith. 73 & 75, Farringdon Rd. & Doctors' Commons

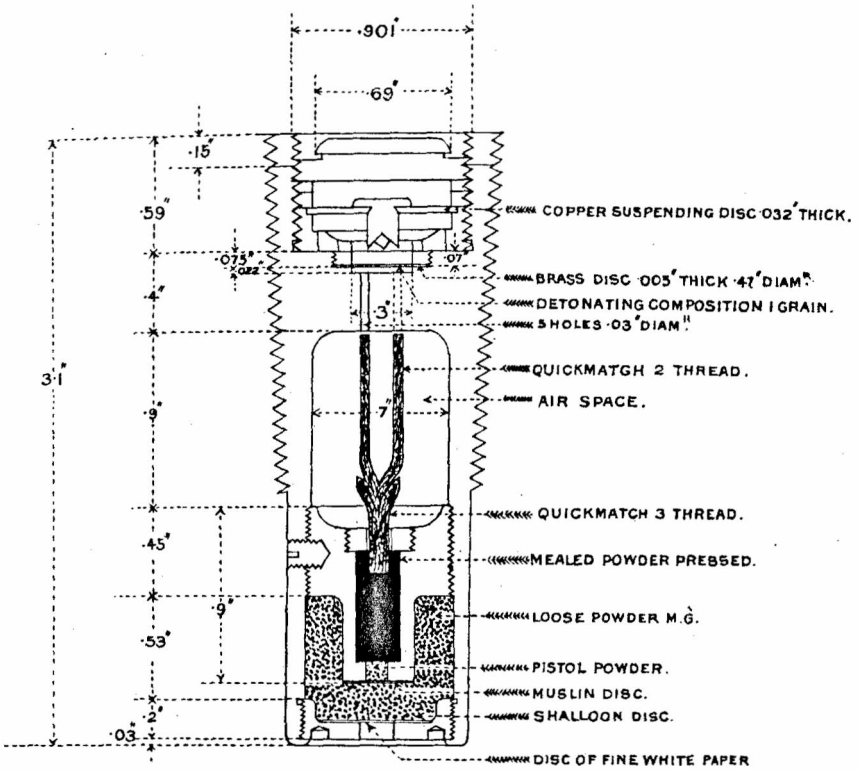
1008. 7/98.

Plate 41.

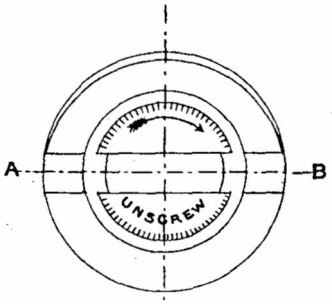
FUZE PERCUSSION DIRECT ACTION DELAY Nº 10 MARK I.

METAL I IN A TIN CYLINDER.

FULL SIZE.



SECTION AT A.B.



PLAN.

Judd & Co Ltd Lith. 73 & 75, Farringdon Rd & Doctors' Commons 1903. 7. 30.